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ADAPTED LAND MANAGEMENT PRACTICES OF FARMERS AND PASTORALISTS IN ESTABLISHING A CLIMATE RESILIENT ENVIRONMENT IN THE SOUTHERN SAVANNA ZONE OF KATSINA STATE, NIGERIA.

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Abstract

This paper aimed at assessing the land management practices adapted by farmers and pastoralists to sustained a resilient environment for their livelihood in areas of Funtua, Bakori and Danja local government areas of katsina state, in the face of climate change. A multi stage sampling technique is used where Stage one involved dividing the local governments into political wards level and randomly select two wards from each local government by applying simple random sampling method. Stage two involved dividing the political wards into settlements and purposively selects two settlements each of farmers and pastoralists, giving a total of six (6) settlements for farmers and six (6) for pastoralists. Stage three involved the

Introduction

Farmers and pastoralists are set of people whose livelihood is tied directly to their environment, which is today affected by the impacts of climate change. The impacts of climate change on farmers and pastoralists cannot be over emphasized as it manifest itself in their social, economic and environmental aspects of livelihood respectively.

The International Panel on Climate Change (IPCC) defines climate change as statistically significant variations in climate condition that persists for an extended period, typically for decades or longer, which is as a result of global warming caused by greenhouse effect (increase in greenhouse gases – notably carbon dioxide (CO2), methane (CH4), nitrous

random selection of ten households from each settlement of farmers and pastoralists and interview three respondents from each house hold selected. This gives total of 120 households from all three local government areas with each having 40 households, and a total of 360 respondents.The data was collected using questionnaire that was developed from the environmental indicators of resilience of the SHARP TOOL, and uploaded onto the kobotool box. Data were analyzed using descriptive statistics of percentages and frequencies. The study reveals that farmers and pastoralists align production with local ecological parameters as their adapted land management practices such as use of leguminous plants, use of fertilizers, weed management practices and agroforestry which gives the environment a natural regeneration capacity, while impacts of Climate variability and change majorly are decline in forest resources, decrease in soil fertility and grazing area. There is the need to enlightened, and research centres to update farmers and pastoralists on strategies to improve environmental resilient.

Keywords: *Land Managements, Practices, Climate, Resilient, Environment*

Oxide (N2O), Ozone (O3), hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), sulphurhexafluoride (SF6) and water vapor (H2O)); variations in earth's orbital characteristics (example: solar output, earth-sun geometry and interstellar dust); and volcanic eruptions - which invariably release large amounts of sulphurdioxide into the atmosphere (Ibe, 2011). Other contributory factors to global warming include some human activities like deforestation, desertification, pollution, land degradation, erosion, emission of greenhouse gases, bush burning, oil spills, gas flaring, waste disposal and population growth (Adejo, Ibrahim and Onuche, 2010; Onumadu, 2012).

Globally, temperatures are rising and rainfall patterns are becoming increasingly unpredictable in many parts of the world. In Sub-Saharan Africa, climate change results in reducing arable and grazing lands; altering the length of the growing season and limiting yields potential (Adejuwon, 2004).Extreme climatic events are multiplying in many regions (Debray, 2015), affecting agricultural production and access to food complicated by rising populations. The Agricultural sector's vulnerability is accentuated by existing challenges for development such as poverty and governance as well

as limited access to capital. Furthermore, ecosystem degradation and complex disasters and conflicts are becoming widespread (Adejuwon, 2004). Farmers and pastoralists are likely to be the most affected whereas they produce about 90% of total agricultural output in Africa (Benin, 2007).

In Nigeria, agriculture is the main source of food and an important employer of labour with about 60% engaged in agriculture (Mayong et al. 2005). Since agriculture in Nigeria is mostly rain-fed, it follows therefore that any change in climate is bound to impact crops and livestock productivity with consequences on the economic activities of the producers (farmers and pastoralists). Studies have reveals that farming and pastoral populations are adapting to changing climates, thus their ability to sustain crop yields notwithstanding the negative effects on land and water quality and availability. This is an indication that the people had developed adaptive measures to reduce their vulnerability (Nelson et al., 2009). For example, in a study of farmers in the northern part of Katsina, Abaje et al.,(2014) identified a number of coping strategies adopted by smallholder farmers in adapting to changing climatic conditions. The Southern Savannah zones of Katsina State are among the most densely populated rural areas in Northern Nigeria, with agriculture being the dominant socio-economic activity. As such, to improve their resilient to the impact of climate variability and change necessitate the need to find and strengthen their land management adaptive measures in the face of climate variability and change. The Self-evaluation and holistic assessment of climate resilience of farmers and Pastoralists (SHARP) tool was adapted to study the adapted land management practices of farmers and pastoralists in establishing a resilient environment to climate variability and change.

AIM and OBJECTIVES

The aim of this research is to assess the adapted land management practices of farmers and pastoralists in establishing a resilient environment to climate variability and change based on the conceptual framework of the SHARP TOOL. To achieve this aim, the objectives of the study base on the environmental resilient aspect of the **SHARP TOOL** are to:-

A. Examine the land management practices of farmers and pastoralists in the study area.

B. Examine the impacts of climate variability and change on farmers and pastoralists in the study area

STUDY AREA

The study is carried out in the southern Savanna zone of Katsina State, covering areas of Funtua, Bakori and Danja local government's areas of Katsina state.

Location and Size

The study area is located approximately between latitudes $11^{0}15^{I}$N and $11^{0}50^{I}$N and longitudes $7^{0}10^{I}$E and $7^{0}45^{I}$E. This area falls within the southern savanna zone of katsina state. The area is bounded to the north by kankara, Malumfashi and Kafur local government areas, to the east and south by Kaduna state, to the west by Faskari and Dandume local governments respectively.

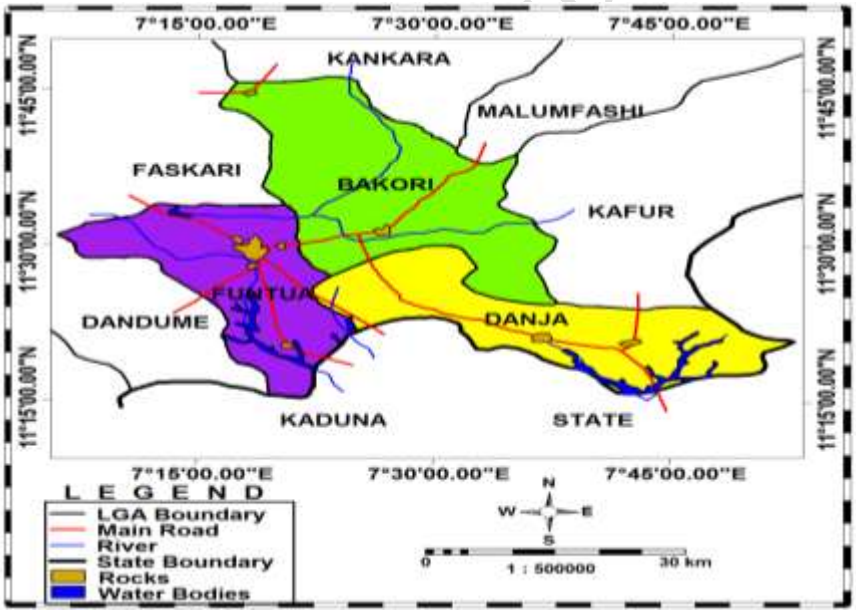

Fig 1.1 Funtua, Bakori and Danja Local Government Areas

Source: GIS Lab, Geography Dept. BUK

The Southern Savanna Zone of Katsina

This area covers the relatively wet southern parts in Katsina State of Nigeria. The local government areas include; Bakori, Dandume, Danja, Faskari, Funtua, musawa, Kafur, Kankara, Malunfashi and Sabuwa. It is located within

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Latitude11º 05´ north of the Equator and Longitude 7º 08´ east of the GreenWich Meridian. The study area is bounded in the north by Dan-musa and Matazu local government areas, in the east by Kano State, in the west by Zamfara State and in the south by Kaduna State. The area falls within the Sudan savanna type of vegetation (Adefila.,2014).

Climate

The area is characterize under the tropical climate zone of Nigeria with two main seasons; rainy season which is from April to October and dry seasons (or Hamattan) for the remaining periods which is typical of northern Nigeria, and which is characterized by sharp regional variances depending on rainfall (Babsal and Co.,1998).Generally, the seasons are moved by the movement of the Inter Tropical Air Mass or Inter Tropical Convergence zone (ITCZ) A zone where dry and often dust-carrying air from the northern Hemisphere, known locally as hammattan collide with moist air from the southern Hemisphere or Atlantic ocean. The study area receives an average precipitation of 1,200 mm per year (Kankara, 2002). Dry season is marked by low humidity and has Harmattan wind that blows from Sahara. The mean monthly temperature is high reading 28.8^{0}c in April and lowest is 21.7^{0}c in December. The area enjoys some four months of rainfall and has some eight months of dryness. Also, the relative humidity is always low about 40% in January and rise to about 60% in July (Odunze, 2006).

Physiography

The area generally falls under the high plains of Hausa highlands with a gently rolling terrain. The highest places are due to gneisses and porphyroblastic granites which form a saddleback at the west. The lowlands are underlain by the more easily weathered quartz feldspar-biotite, Schist and Serpentimite of the Basement complex. The gently undulating peneplained surface, consist of an extensive superficial cover which rises to an altitude of between 570m and 600 m above mean sea level (kankara 2014).

Soil and Vegetation

The Soils are largely clayey soils (locally called *"Laka"*) and about five meters in depth, and fine in texture. In fact, the soil type in the area and the whole of southern katsina has been described as the most fertile land of katsina area

(Tukur 2009). Most of the soil is formed by alluvial material that is fairly rich in nutrients and has the capacity of retaining moisture for quite sometimes. This good moisture retention sometimes persists up to the dry season. The fertility of the soil in this zone makes agricultural production of cash crops such as sugar cane, cotton, tobacco, and pepper possible. The area is very popular in the production of food crops such as guinea corn, millet, rice, maize, beans and groundnut (Tukur 2009).

The vegetation of the area is the savanna type of vegetation, influenced by the amount of rainfall received in the area and the relative humidity. It is predominantly of woodland, characterized with short grasses and stunted trees that are scattered. The tallest trees in the area are the silk-cotton trees with a height of about 30ft. some of the typical food and economic trees in the area are: the locust beans (*Dorawa*), sheanut (*Butyrospermum parkii*), Baobab (*Adansonia digitata)*, Tamarind (*Tamarindus indica*), Ebony (*Diospyros ebenum*), and Mahogany *(swietenia macrophylla)*. Other species include the Neem tree (*Azadirachta indica*), African locust bean (*Parkia biglibosa),* Mango(*Magnifera indica*) and Palm (*Arecaceae*) which are mostly exotic trees (Tukur 2009).

Landuse and Population

Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods (Abdulkadir, 2011). It also has been defined as "the total of arrangements, activities, and inputs that people undertake in a certain land cover type (Mortimore,1970). In the study area, the major land use are Built-up areas: include educational, health, and socioeconomic facilities like; games/sport viewing centers and shops, Agricultural land use which encompasses both cultivated, irrigated lands and grazing lands, water Bodies which include Rivers and Streams (Tukur 2009). The area is drained by river yagana and ubangida which where dammed as lake Gwaigwaye and Mairuwa respectively. Transportation is another land use in this area. The transport systems include roads and rail with other minor roads and foot path. Range lands are other land use of the area with Fulani pastoralists as one of the dominant tribes in the area. According to the 2006 the area has a total population of 1337389 people (Tukur 2009).

The predominant tribes in this area are the Hausas' and Fulanis', as such the major agricultural activities are crops cultivation and livestocks rearing. The Hausa's are being more into cropS cultivation, while livestock grazing is done almost exclusively by the Fulanis who kept livestock for both themselves and on behalf of the Hausa's. The Fulani's are primarily settled or semi settled cattle herders with little engagement in crop cultivation.

MATERIALS AND METHODS

Sampling Procedure

The study area is purposively selected from the relatively wet southern parts of katsina state as was attested by Adefila (2014). The research adopts the multi-stage sampling technique because of unavailability of exhaustive list of farmers and pastoralists in the study area. It is the characteristics of multi stage sampling method that when there is no exhaustive list of sample elements or good sampling frame for a disperse population, then multi stage sampling technique is appropriate (Neuman, 2004).

Stage one involved dividing the local governments into political wards level and randomly select two wards from each local government by applying simple random sampling method. Stage two involved dividing the political wards into settlements and purposively selects two settlements each of farmers and pastoralists, giving a total of six (6) settlements for farmers and six (6) for pastoralists. Stage three involved the random selection of ten households from each settlement of farmers and pastoralists and interview three respondents from each house hold selected. This gives total of 120 households from all three local government areas with each having 40 households, and a total of 360 respondents.

INSTRUMENT OF DATA COLLECTION

The instruments of data collection for this research work are the questionnaire and kobotool box .The kobotool box is an android base application that allows preparing a digitally programmed questionnaire, facilitates intense monitoring of the collection process and gathering of data immediately after survey in a format prepared for analysis.

Questionnaire

Structured questionnaire was designed comprising of closed ended questions. The questionnaire elicited for information on land management

practices and weather elements variation within the time frame of 10 years (2007 to 2016), The questionnaire was uploaded onto an Android supported **kobotool box** software for ease of on-field digital data collection.

METHODS OF DATA COLLECTION

Six (6) field assistants were engaged to conduct field data collection using the **kobotool box** installed on mobile phones. To ensure quality data collection, the Research Assistants were trained for three days on how to collect data using the **kobotool box.** The respondents were asked questions from the tool and their response is typed on the tool.

DATA ANALYSIS

Descriptive and inferential statistics were employed for the purpose of data analysis. Data for objective A and B were analyzed using descriptive statistics of percentages and frequencies and results were presented using graphical statistical representations.

RESULTS AND DISCUSSIONS

The information collected from the questionnaire survey was analyzed and presented in the following sections.

SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Table 1: Socioeconomic Characteristics of the Sampled Household

Variable	Category	Frequency	Percentage
Gender	Male	337	93.61
	Female	23	6.39
Age group	31+	209	58.06
	26-30	100	27.78
	21-25	46	12.78
	16-20	4	1.11
	0-15	1	0.28
Level of education	Qur'anic school	226	62.78
	Secondary school	68	18.89
	Tertiary institution	39	10.83
	Primary school	21	5.83

	No education	6	1.67
Household size	**Category**	**Frequency**	**Percentage**
Farmers	0-4	13	3.49
	5-9	54	14.92
	10-14	90	25.08
	15-19	11	3.17
	20+	5	1.27
Pastoralists	0-4	19	5.40
	5-9	74	20.63
	10-14	30	8.25
	15-19	9	2.54
	20+	8	2.22
Other (agro-pastoralists)	0-4	5	1.38
	5-9	19	5.27
	10-14	11	3.05
	15-19	8	2.22
	20+	4	1.11
Farming system practiced	**Category**	**Frequency**	**Percentage**
Farmers	Wet season cropping	134	37.22
	Irrigation farming	55	15.27
	Both systems	26	7.22
Pastoralists	Wet season cropping	19	5.27
	Irrigation farming	6	1.66
	Both systems	8	2.22
other (agro-pastoralists)	wet season cropping	52	14.44
	irrigation farming	32	8.88

Source:*field survey 2017*

The socio-economic information collected from the household survey includes gender, age, house hold size, level of education, dominant agricultural practices. The result is presented in table 1 Majority (93.61%) of

the respondents are male, while (6.39%) are female. The large proportion of male respondents cannot be unrelated with the fact that cultural and religious values in this part of the country limits most women from engaging in farming and other related activities. This is in line with the study of kiyawa (2016).

In terms of age distribution majority (58.06%) of the respondents are within the age range of 31 and above, followed by 27.78% with the range of 36-30 years). This indicates that majority of the respondents fall within the economically active population that are industrious and productive, whom will be able to speak on issues of environment. This was agreed by Ahmad (2016).

The table also shows that majority of the respondents (62.78%) have qur,anic education, 18.89% have secondary school certificates, 10.83% have tertiary institutions certificates, 5.83% are primary school leavers and only 1.67% are without any form of education. This turn out of respondents level of education, with qur,anic education having highest percentage, cannot be unconnected to the fact that the predominant religion in this part of the country is Islam and the prevalence of Islamic teaching schools in the rural communities. The positive turnout of western education cannot be unconnected with the awareness they get on importance of western education and also the establishment of universal basic education, that resulted in the establishment of many primary and junior secondary schools in the rural communities.

Adapted Land Management Practices

The analysis below shows the adapted land management practices of farmers and pastoralists in the study area to sustain their environmental resilient to climate variability and change.

Use of Leguminous Plants

According to Rajeev (2013) "Legumes are grown agriculturally, primarily for human consumption, for livestock forage and silage, and as soil-enhancing manure". From table 3, the result shows that 57.22%, 10.98% and 14.72% farmers pastoralists and agro pastoralists respectively reported the use of leguminous crops on their farms and range lands, 9.72% farmers and 6.27% pastoralists, responded on poor use of leguminous plants on their farms and range lands. The result indicates that farmers and pastoralists use

environmentally friendly means of managing their farm and range lands. The use of legumes has a wide scope for restoring extreme soil loss and soil nutrients loss (Ibrahim and Lawal 2013). This will reduce the rate of inorganic fertilizer application that sometimes increase rate of land degradation (Lawal 2017) From the high percentage of pastoralists response(10.98%), indicates that any short time recede of forage for their livestock can be alleviated by supplementation through extending the grazing season by including leguminous crops in range management , this is agreed by FAO (2009).

Table 3: Use of Leguminous Plants

Respondent	Response	Frequency	Percentage (%)
Farmers	% of farmers that have leguminous crop on their farms.	206	57.22
	% of farmers that do not have leguminous crop on their farms.	35	9.72
Pastoralists	% of pastoralists that have leguminous crop on their rangelands.	23	6.27
	% of pastoralists that do not have leguminous crop on their rangelands.	40	10.98
Other (agro-pastoralists)	% of agro-pastoralists that have leguminous crop on their farms.	54	14.9
	% of agro-pastoralists that do not have leguminous crop on their farms.	3	0.78
Total		**360**	**100**

Source: *Field survey, 2017*

USE OF FERTILIZER

40.55% farmers, 3.33% pastoralists and 20.55% agro pastoralists report using synthetic or inorganic fertilizer on their farms and range lands. While 20.83% farmers, 4.16% pastoralists and 10.55% agro pastoralists respond to using organic fertilizer on their farms and range lands. This indicates that the respondent depend highly on inorganic fertilizer for their farms/range lands yields. The low use of organic fertilizer cannot be unconnected with their access to this type of fertilizer as every rural household keeps organic fertilizer for their usage. It can also be seen that farmers and agro pastoralists use organic fertilizer more than pastoralists, thus, this can be due to their dominant crop cultivation. The results further indicate an average use of both organic and inorganic fertilizers, with inorganic being the most important source of nutrients as supported by Kabir, Sultan, &Attia (2015). The result shows that the environment requires less external inputs for farms and range lands productivity. The use of fertilizer/animals dung to improve crop yield is a sustainable adaptation strategy (Abaje , Sawa, & Ati, 2014). Thus, a sustainable adaptation strategy enhances environmental resilience (carpenter et al, 2001).

Table 4 : Use of fertilizer

Respondent	Response	Frequency	Percentage (%)
Farmers	Synthetic fertilizer	128	35.55
	Organic or natural fertilizer	84	23.33
Pastoralists	Synthetic fertilizer	12	3.33
	Organic or natural fertilizer	15	4.16
Other (agro-pastoralists)	. Synthetic fertilizer	74	20.55
	Organic or natural fertilizer.	47	13.05
Total		**360**	**100**

Source: *Field work, 2017*

Agro-forestry practice

Agro-forestry is a dynamic, ecologically based, natural resources management system that, through the integration of trees on farms and in the

agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. By nurturing trees on their farms, pastures and homesteads farmers have been managing agroforestry systems for millennia(ICRAF 2006).From table 5, it shows 38.55% farmers, 18.07% pastoralists and 13.65% agro pastoralists reported practicing assisted natural regeneration as a form agro forestry. While 5.62% farmers, 17.27% pastoralists and 6.83% agro pastoralists attested to practicing tree planting. The result indicates that farmers and pastoralists in the area practiced assisted natural regeneration on their farms and range lands which is the maintenance of these trees on their farm/range, this is a natural conservation practice Koffa,and Garrity, (2001). The practice of agro forestry enhances the functions of environmental diversity (Dangasuk et al., 2001).

Table 5: Agro-forestry practice

Respondent	Response	Frequency	Percentage (%)
Farmers	Assisted natural regeneration	139	38.55
	tree planting	20	5.62
Pastoralists	Assisted natural regeneration	65	18.07
	tree planting	62	17.27
Other (agro-pastoralists)	Assisted natural regeneration	46	13.65
	tree planting	25	6.83
Total		**360**	**100**

Source: *Field work, 2017*

Use of Cover Crops

According to Kaspar and Singer (2011), cover crops are used to manage soils for many different reasons and are known by many different names.Cover crops are literally "crops that cover the soil" and one of their first uses was to reduce soil erosion during fallow periods in annual cropping systems. Cover crops are also known as "green manures," "catch crops," or "living mulch." Green manure cover crops are usually legumes that fix N and are grown to provide N to crops. Catch crops are cover crops that are grown during fallow

periods in cropping systems to take up nutrients, especially N, that would be lost if plants are not present. From table, 25.86% farmers, 19.83% pastoralists and 13.36% agro pastoralists reported that they use cover crops on their farms/range lands often. The use of cover crops by pastoralists cannot be unconnected with their need for continuous supply of forages for their livestock feeds.

This was disagreed by kim (2016) as he said that pastoralists use cover crops on their range land as a coping strategy to climate variability and change. The use of cover crops by farmers cannot be unconnected with the need to prevent soil degradation such as erosion and desiccation (Kabir, Sultan, & Attia 2015).

Table 6: Use of Cover Crops

Respondent	Response	Frequency	Percentage
Farmers	A lot	93	25.86
	Average	76	21.12
	Completely	20	5.6
	Not at all	9	2.59
	A little	6	1.72
Pastoralists	A lot	71	19.83
	Average	12	3.45
	Completely	2	0.43
	Not at all	6	1.72
	A little	2	0.43
Other (agro-pastoralists)	A lot	48	13.36
	Average	5	1.29
	Completely	6	1.72
	Not at all	0	0
	A little	3	0.86
Total		**360**	**100**

Source:*Field work, 2017*

Weed Management Practices

From table 7, 32.50%, 4.44% & 7.77% farmers, pastoralists and agro pastoralists respectively reported use of herbicides for weed management on

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their farms and range lands. While 1.38% farmers, 2.22% pastoralists & 0.83 % agro pastoralists respond to livestock grazing as a means of weed management, 13.05% farmers, 4.16% pastoralists % 6.11% agro pastoralists reported hand weeding or hoe weeding as a weed management practice. 10.00% farmers, 2.77% pastoralists & 6.11% agro pastoralists reported using cover crops as a weed management practice. The results indicate that use of herbicides is the major weed management practice use by the respondents which cannot be unconnected with how cheaper and fast this means of weed management is. According to Chikoye et al., (2004); and Ali et al., (2003) identified herbicides use by smallholder farmers as a better alternative to manual weeding because it is cheaper, faster, and gives better control as well as increases biological yield and decreased weed biomass. This is followed by hand weeding and use of cover crops. Hand weeding or Manual weeding is the predominant method of control used by smallholder farmers in Africa (Chikoye *et al.*, 2002).the use of cover crops indicate an environmentally friendly management practice and according to Carpenter et al. (2001), this will enhance the function of ecosystem diversities and in turn influence the environmental ability to withstand shocks.

Table 7: Weed Management Practices

Respondent	Response	Frequency	Percentage (%)
Farmers	Herbicides	117	32.50
	Livestock grazing	5	1.38
	Hand weeding	47	13.05
	other crops	20	5.55
	Cover crops	36	10.00
Pastoralists	Herbicides	16	4.44
	Livestock grazing	8	2.22
	Hand weeding	15	4.16
	other crops	4	1.11
	Cover crops	10	2.77
	Herbicides	28	7.77

Other (agro-pastoralists)	Livestock grazing	3	0.83
	Hand weeding	22	6.11
	other crops	7	1.94
	Cover crops	22	6.11
Total		**360**	**100**

Source: *Field work, 2017*

Impacts of Climate Variability and Change

Although, the impacts of climate change can be socio economic or climatic impacts Adejuwon. (2004)., table, presented the climatic impacts of climate variability and change. Climatic impacts are those impacts that are mostly the consequences of change/variability in climate and weather conditions and to very large extent anthropogenic activities (Adejuwon 2004). From table 8 above; 16.66% farmers reported decrease in soil fertility as the major impact of climate change, while 11.94% pastoralists whom are the majority reported decline in forest resources as a major impact of climate variability and change, and 5.00% agro pastoralists also reported decrease in soil fertility. This response by farmer's pastoralists and agro pastoralists cannot be unconnected with their livelihood option. This also indicates the major impact of climate change on livelihood options of farmers and pastoralists in the area. This is in line with the study of Awotodunbo,(2012), as he observed that decrease in soil fertility and decline in forest resources as a significant impacts of climate variability and change as perceived by farmers in katsina. The second major impact of climate change as reported by farmers 14.72% is decline in forest resource, while 9.17% and 4.17% pastoralists and agro pastoralists reported decrease in grazing land. This cannot be unconnected with their livelihood options. The decline in forest resources and decrease in grazing in area cannot be unconnected with deforestation, encroachment and bush burning. This result in aggravating the impacts of climate variability and change which in turn will leads to disappearance of trees species not adaptable to the environmental changes which according to Carpenter et al. (2006), will affect the environmental regeneration. As cited by Hoff et al (2003), the capacity of the environment to regenerate naturally is a major factor common to resilient environment.

Table 8: Impacts of Climate Variability and Change

Respondent	Response	Frequency	Percentage (%)
Farmers	Decline in forest resource	53	14.72
	decrease in soil fertility	60	16.66
	Decrease in grazing land	5	1.38
	Increase in animal pest and disease infestation	18	5.00
	Increase in death of livestock	12	3.33
Pastoralists	Decline in forest resource	43	11.94
	decrease in soil fertility	16	4.44
	Decrease in grazing land	33	9.17
	Increase in animal pest and disease infestation	27	7.50
	Increase in death of livestock	26	7.22
Other (agro-pastoralists)	Decline in forest resource	14	3.88
	decrease in soil fertility	18	5.00
	Decrease in grazing land	15	4.17
	Increase in animal pest and disease infestation	13	3.61
	Increase in death of livestock	7	1.94

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Total		**360**	**100**

Source:*Field work, 2017*

Conclusion

The study reveals that farmers and pastoralists align production with local ecological parameters as their adapted land management practices, according to Cabell, and Oelofse, (2012), aligning production of farmers and pastoralists with both local and ecological parameters such as use of leguminous plants, use of fertilizers, weed management practices will gives the environment a natural regeneration capacity which according to Carpenter et al (2001), the ability of the environment to regenerate determines It's resilient to climate variability and change and also shows a great sense of awareness on climate variability and change impacts among farmers and pastoralists. The impacts of Climate variability and change which manifest itself in terms of decline in forest resources, decrease in soil fertility and grazing area indicate the inadequacy and ineffectiveness of these adapted practices in light of increasing effects of future variability and change.

Recommendations

The recommendations drawn will establish areas where intervention is needed to sustain the livelihood of farmers and pastoralists in the face of major climate stresses. They will also help to conserve the natural environment. These recommendations are;

1. Farmers and pastoralists should be enlightened on management practices ideas to improve their buffer capacity and influence the environmental resilient.
2. Invest to generate and disseminate in understandable format client-oriented climate information to help farmers and pastoralists make informed decisions on their management practices. This should be accompanied by relevant extension services e.g. on crops, livestock and viable land management adaptation strategies.
3. Research Centres and institutes that should update the farmers and pastoralists on climate change related issues and the need for environmental resilient practices should be established by both State and Federal Government and existing ones revived. This will therefore strengthen the farmers' and pastoralist's capacity to improve on their

management strategies to sustain their environmental resilient to climate variability and change impacts.

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