academicJournals

Vol. 5(10), pp. 403-410, October, 2013
DOI 10.5897/JDAE2013.003
ISSN 2006-9774 © 2013 Academic Journals
http://www.academicjournals.org/JDAE

Journal of Development and Agricultural Economics

*Full Length Research Paper*

# Assessment of effect of climate change on the livelihood of pastoralists in Kwara State, Nigeria

**I. F. Ayanda**

Department of Agricultural Economics and Extension Services, Kwara State University, Malete, Nigeria.

Accepted 27 July, 2013

**The study examined socio-economic characteristics of pastoralists, investigated perceived effects of climate change on grazing land, herd's performance and changes in livelihood of the pastoralists. Through a multi-stage sampling technique, 140 pastoralists were randomly selected. Data were collected using interview scheduled and analyzed by percentages, frequency, tables and Chi square statistical tools. The result of the study showed that respondents were with an average age of 49.7 years. 10.8 and 5% of the pastoralists had primary and secondary education, respectively. Furthermore, 67.5% of the pastoralists strongly agreed that pattern of rainfall in recent time affects pasture availability while 47.5 and 52.5% reported a decline in milk production and an increase in herd mortality respectively. Pastoralists advanced diminishing land for cattle grazing, poor quality pasture, inadequate income and a decline in cattle productivity as reasons for diversifying into crop production and other enterprises. A significance relationship was established between herd's milk production and factor of climate change (calculated $x^2$ = 52.00, tabulated $x^2$ = 7.8147, p≤0.00). It was concluded that climate change adversely affected livestock performance. Pastoralists should be encouraged through extension services to diversify production while livestock rearing is not compromised. This in turn will fast track Nigeria's strive for self-sufficiency in food production and employment generation.**

**Key words:** Irregular rainfall pattern, declining grazing land, low herd production, income, crop, other enterprises.

## INTRODUCTION

Transhumance pastoralism was originally a way of life among communities whose lives and livelihood are inseparably intertwined with cattle, goats, sheep and other ruminant species that depend on natural rangeland for grazing resources. In spite of the advent of monetized economy, pastoralism has remained a veritable source of livelihood and food security as cattle, goats and sheep perform economic, as well as traditional, social and exchange functions. However, the world is witnessing the adverse effects of climate change which include frequency and intensity of storm, thunder, flood, drought, hurricanes, increased frequency of fire, poverty, reduced agriculture productivities, adverse effects on grazing land and pasture quality. It had a cumulative effect on natural resources and disruption of eco-system. The impact of climate change can be vast. In Nigeria, this means that some stable ecosystems such as the Sahel Savanna may become vulnerable because warming will reinforce existing patterns of water scarcity, increasing the risk of drought in Nigeria and most countries in West Africa. It is obvious from the definition that climate change is an inherent attribute of climate, which is caused by both

E-mail: iayanda@yahoo.com. Tel: +234(0)8033737391.

human activities (anthropogenic) and natural processes (bio-geographic) (IPCC, 1996). As a result of climate change, the pastoralists migrated from the northern parts of the country to southern parts in search of pasture and water. The migration increases pressure on land use. Climate change also influences the existing vegetation type which favours cattle production in many southern parts of Nigeria. Presently, some of the land-use practice of the pastoral Fulanis such as seasonal bush burning along the grazing orbits for regeneration of pasture, periodic movement of the huts or dwelling place within the settlement areas, intensification of land use, shifting cultivation with short fallow periods and lack of commitment to investment in long-term land improvement initiatives such as incorporation of leguminous species into pasture or grazing land cover, loss of bio-diversity is capable of compromising the integrity and resilience of the ecosystem (Ayoade, 2004) and are plausible reasons for the ubiquitous face off between crop farmers and pastoralists.

Climate change as suggested by some researchers could impact the economic viability of livestock production systems worldwide. Surrounding environmental conditions directly affect mechanisms and rates of heat gain or loss by all animals (NRC, 2002). Lack of prior conditioning of livestock to weather events often results to catastrophic losses in the domestic livestock industry. It also affects the feed intake of the animal because ingestion of food is directly related to heat production, any change in feed intake and /or energy density of the diet will change the amount of heat produced by the animal. The ambient temperature has the greatest influence on voluntary feed intake. The ever growing pressure on land in the past few years has been described by many experts as a clear manifestation of the impact of climate change across Nigeria with most states in the far North being the worst affected by these changes. This has put the pastoralists in a state of dilemma (Omotayo, 2010). The pastoral Fulani believes that animal reproduction does not depend on the fecundity of the breed but rather on proper nutrition. Current efforts to combat global warming focus on reducing the emission of heat-trapping gases, but do not fully address the substantial contribution of land use to climate change, since even small changes of $100^2$ km in urban development or deforestation can change local rainfall patterns and trigger other climate disruptions (BNRCC, 2008).

## Problem statement

The bulk of locally produced meat and milk in Nigeria are through transhumance pastoralists. The dwindling pastoral and water resources such as open rangelands, wetlands (Fadama land), watercourses and rivers present a new challenge to pastoralism (Adamu, 2008). This could be held responsible for the low productivity of their cattle over the years. The situation is aggravated by climate change which exposed the pastoralists and their herds to tougher weather situations especially drought, poor quality pasture, risk of contacting diseases, pests, conflict between the pastoralists and crop producers over land use. The ever growing pressure on land in the past few years arising from population explosion, industrialization and institutional development has been described by many experts as a clear manifestation of the impact of climate change across Nigeria (Heinrich Boll Foundation, 2000). The problem of the pastoralists is further compounded with various agricultural development programmes which made pumps available for agricultural production in fadama area. Increasingly, however, pastoralists discovered that the rivers where they grazed their animals are now blocked off by farms and gardens. The problematic issues of customary tenure surfaces once again.

In Kwara State, farmers tend to farm in the designated grazing reserves because the land is particularly fertile. This marked the beginning of conflict in Bankubu, Baruten Local Government Area of the state. Today, there is increasing number of conflicts in many parts of Kwara State and the country at large (Joseph, 2012; Ademola, 2012) which resulted in huge losses in lives and properties.

In recent times, drought and flood are unpredictable and are more frequently occurring. This had a cumulative effect on natural resources and disruption of eco-system. Climate change reduced available land for livestock production purposes because of desert encroachment currently moving at 600 m/annum (or 350,000 ha per annum) (IPCC, 2007b, Oyetade, 2007). Consequently, pastoralists migrated to the southern part of the country where pasture and water are better guaranteed, an action, which often results into conflict between crop farmers and pastoralists with attendant low productivity which engulfed the agricultural sector in Nigeria. This forced the government to rely mostly on food importation to the extent that in 2007 the Federal government expended a total of N78.026 on milk importation in 2008 (National Bureau of Statistics, 2009), a situation described as dangerous for the nation's economy (Olayemi, 2005).

Cattle, sheep and goat performed better (in terms of calving, growth, milk production, etc) within a temperature range between 10 and 20°C called Comfort Zone" (McDowell, 1980). The temperature range in Kwara State is between 30 and 35°C. This is above the comfort zone and is capable of predisposing the animals to thermal stress which in turn can undermine the productivity of the animals. Irregular rainfall pattern also drastically affected the availability of water and pasture. Conducive weather condition, water and food are important in the physiological processes of these animals. In Nigeria therefore, it is not out of place to assume that the

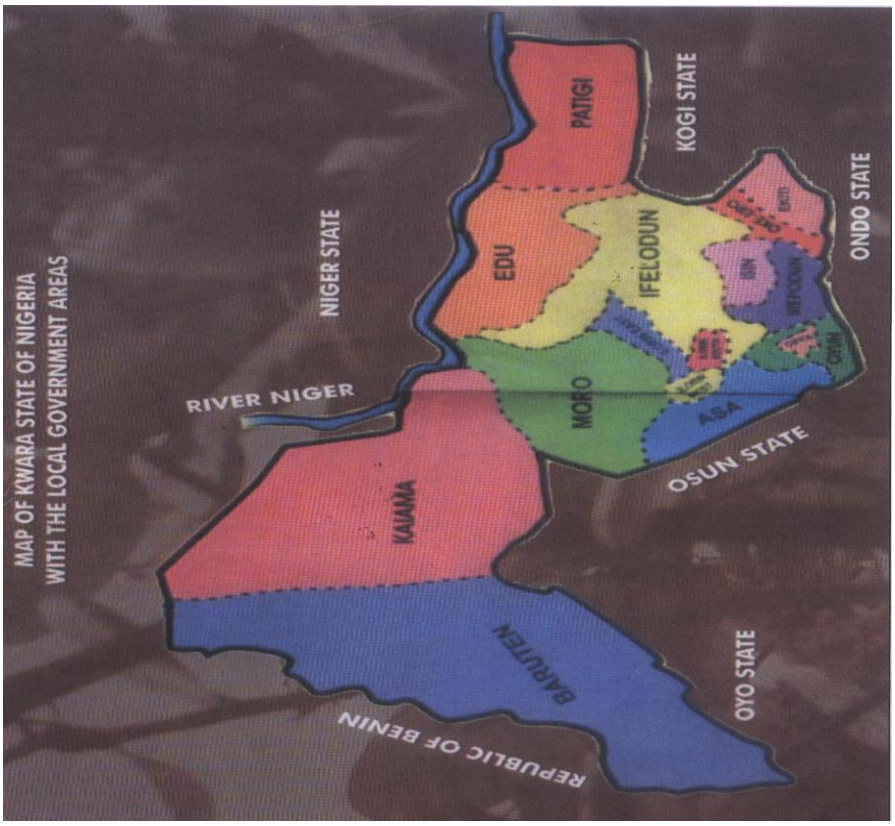


**Figure 1.** Map of Kwara State showing the sixteen local government areas.

prevailing environmental situations may be an eye opener for the pastoralists to look for alternative means of livelihood. These necessitate this study. The study was undertaken to provide answers to these research questions. What are the socio-economic characteristics of the pastoralists? To what extent has climate change affected grazing land? What are the perceived effects of climate change on the performance of the herds? And what are the changes in the means of livelihood of pastoralists due to climate change?

It is expected that the outcome of this study will assist the policy makers, planner, donors, public and private extension organizations to include the pastoralists in policy, programme planning and implementation relating to crop production and other enterprises aimed at increasing food production and employment generation.

## Objectives of the study

The objectives of the study were to:

1) Describe the socio-economic characteristics of the pastoralists,
2) Determine perceived effects of climate change on grazing land in the study area,
3) Investigate perceived effects of climate change on herd's performance,
4) Identify changes in means of livelihood of the pastoralist due to climate change.

## Hypothesis tested

The following hypotheses were tested:

1) There is no significant relationship between effect on grazing land and climate change,
2) There is no significant relationship between performances of the herd and climate change.

## METHODOLOGY

### The study area

The study was carried out in Kwara state, Nigeria which is located within the North Latitude 11° $2^1$ and 11° $45^1$. It falls between longitudes 2° $45^1$ and 6° $40^1$ East of Greenish meridian (Figure 1). The state is bounded in the south with Oyo, Ekiti and Osun State. It is bounded in the West by Benin Republic while in the North and the East, it is bounded by River Niger, and Kogi State, respectively. The state has a land area of $32,500^2$ km (3,250,000 ha) with a temperature range between 30 and 35°C. The vegetation in the

northern parts of the State is mainly savannah grass land while to the southern part is wooded Guinea Savannah. The rainfall pattern both in quantity (900 to 1500 mm) and distribution (6 to 7 months) and vegetation types favour production of cattle, goat, sheep and arable crops. The favourable climatic conditions are responsible for the exodus of Fulani from the northern parts of the country where adverse effects of climate change are mostly felt. The population of Kwara State is 2.3 million people (NPC, 2006). Kwara State is naturally endowed for livestock production. Crop production (rice, yam, cassava, guinea corn, maize, groundnut, sweet potato, cotton etc) is the major farming enterprise of the major tribes (Yoruba, Nupe and Baruba) in the State while livestock production is the major means of livelihood of the migrants Hausa/Fulani.

#### Target population

The target population for the study was the pastoralists in the sixteen local government areas (LGAs) of Kwara State. The local governments areas include Asa, Ilorin East, Ilorin West, Ilorin South (Kwara Central); Baruteen, Kaiama, Edu, Patigi and Moro (Kwara North); Irepodun, Ifelodun, Oyun, Offa, Ekiti, Oke-Ero and Isin (kwara South). There are preponderance of crop farmers and pastoralists in all the 16 LGAs in the state. The pastoralists constitute the sample frame from which the respondents were selected.

#### Sample size and sampling technique

The study used a multistage sampling technique. Stage one involved a random selection of seven (43.75% of the LGAs in the state) local government areas. These include Asa, Moro, Isin, Ifelodun, Kaiama, Edu and Baruteen LGAs. Stage 2 involved a random selection of five pastoralists' settlements (Gaa) in each LGA. The 'extension agents' in each LGA assisted in the compilation of the lists of the pastoralists, to the extent possible, within their areas of jurisdiction. Twenty (20) pastoralists were randomly selected from the five (5) Gaas in each LGA. Thus, a total of 140 pastoralists were selected from the seven (7) LGAs as respondents. Data were collected by means of structured interview schedule and analyzed with percentages, frequencies, tables and Chi-square statistics.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of the pastoralists

The result of the study as shown in Table 1 indicated that 46.4% of the respondents were in the age range of 51 to 60 while the mean age of the respondents was 49.7 years. At this age, Ismaila et al. (2010) reported that farmers are incapable of handling tedious farming activities such as covering long distances to graze the animals. Unless the pastoralists are well-nourished, covering long distances may have implications on their health status. This can be subject of another research. However, low level (7.9%) of youth in the age bracket of 21 to 30 years was involved in transhumance pastoralism. It is possible that the youth diversified to other areas of the economy for their livelihood. Majority (90%) of the pastoralists were male. This implies that majority of the listed respondents were male; although, the roles of female in pastoralism are also important especially in processing and marketing of livestock products. About half (50.8%) of the respondent acquired quranic education suggesting that pastoralists in the study area are mostly adherent of Islamic faith. However, 10.8 and 5% had primary and secondary education respectively, a reflection of the level of formal education among the pastoralists in the study area. Educational pursuit of the youth explains the low number of pastoralists (7.9%) that fell within the age bracket of 21 to 30 years of age.

It was also revealed that 32.1% of the respondents spent 31 to 40 years with an average of 29.57 years in transhumance pastoralism. It was 35.8% of pastoralists with herd size in the range of 21 to 30 heads of cattle while the average herd size was 21. Inability to maintain larger herd size could be linked with poor quality pasture, inadequate water resulting from increasing desertification in Nigeria. This supports the findings of Brenjo (2007) that the environment can no longer support all of its occupants when hectares of grazing land turn into desert in Sudan. This increases conflict and distrust and further separates the Arabs (pastoralists) and non-Arabs (farmers) in Sudan from reaching an agreement over land use (An-Naim, 2004). Many (62.8%) of the respondents fell within the age bracket of 51 years and above. Therefore, age factor might inform the basis for diversification into crop and other enterprises that require less of wandering and favour sedentary life. The results showed that 65% of pastoralist cultivated 1 to 3 ha with an average of 1.7 ha of land for crop production. This is greater than the national average of 0.57 ha per farmer (Ingawa, 2005). It follows that if the pastoralists were integrated into the national extension services delivery systems, they could be part of national progress to achieve self-sufficiency in food production. However, pastoralists should be exposed to modern animal husbandry practices to assist in coping with the adverse effects of climate change so that livestock rearing would not be compromised as this can affect local supply of animal protein.

### Perceived effects of climate change on grazing land

The results (Table 2) revealed that 67.1% of pastoralists strongly agreed that irregular pattern of rainfall in recent time affects pasture availability implying that the pastoralists would have to wander a long distance in search of pasture and water. About half (52.5%) strongly disagreed that pasture and water is readily available throughout the year in their domain while 52.1% disagreed that prevailing temperature has no effect on the pasture. In addition, altogether, 65% disagreed that drought is not a common occurrence in their localities. These agreed with the findings of BNRCC (2008) that the impact of climate change can be vast. In Nigeria, this means that some stable ecosystems such as the Sahel

**Table 1.** Socio-economic characteristics of the pastoralists fulanis.

| Characteristics | Frequency | Percentage = 100 N = 140 |
|---|---|---|
| **Age (years)** | | |
| 21-30 | 11 | 7.9 |
| 31-40 | 14 | 11.0 |
| 41-50 | 27 | 19.3 |
| 51-60 | 65 | 46.4 |
| > 61 | 23 | 16.4 |
| Average | 49.7 | |
| **Gender** | | |
| Male | 126 | 90.0 |
| Female | 14 | 10.0 |
| **Marital status** | | |
| Single | 19 | 13.6 |
| Married | 91 | 65.0 |
| Widowed | 20 | 14.3 |
| Divorced | 10 | 7.1 |
| **Household size** | | |
| ≤ 5 | 97 | 69.3 |
| 6-10 | 40 | 28.6 |
| 11-15 | 3 | 2.1 |
| Average | 6 | |
| **Educational level** | | |
| No formal education | 39 | 28.4 |
| Adult education | 8 | 6.0 |
| Quaranic education | 71 | 50.8 |
| Primary education | 15 | 10.8 |
| Secondary education | 7 | 5.0 |
| **Years spent in cattle rearing** | | |
| 1-10 | 8 | 5.7 |
| 11-20 | 13 | 9.4 |
| 21-30 | 44 | 31.4 |
| 31-40 | 45 | 32.1 |
| ≥ 41 | 30 | 21.4 |
| Average | 29.57 | |
| **Size of herds** | | |
| ≤ 10 | 24 | 20.0 |
| 11-20 | 37 | 30.8 |
| 21-30 | 43 | 35.8 |
| 31-40 | 16 | 13.4 |
| Average | 21 | |
| **Farm size (hectares)** | | |
| <1 | 44 | 31.4 |
| 1-3 | 91 | 65.0 |
| -6 | 5 | 3.6 |
| Average | 1.7 | |

Source: Field survey (2012).

**Table 2.** Perceived effects of climate change on grazing land.

| Perceived effects of climate change | SA | A | U | D | SD |
|---|---|---|---|---|---|
| Irregular pattern of rainfall in recent time affected pasture availability | 94 (67.1) | 33 (23.6) | 4 (2.5) | 5 (3.3) | 4 (2.5) |
| Prevailing temperature has no effect on the pasture | 7 (5) | 29 (20.7) | 0 (0) | 73 (52.1) | 31 (22.2) |
| Flood occurrence hinder pasture growth | 35 (25.0) | 28 (20.0) | 2 (1.2) | 71 (51.3) | 4 (2.5) |
| Drought is not a common occurrence in your location | 18 (12.5) | 24 (17.5) | 7 (5.0) | 35 (25.0) | 56 (40.0) |
| Pasture is readily available throughout the year | 21 (15.0) | 15 (11.2) | 4 (2.5) | 74 (52.5) | 26 (18.8) |
| Water is readily available throughout the year | 16 (11.2) | 12 (8.8) | 5 (3.8) | 44 (31.2) | 63 (45.0) |
| You cover long distance to grace your animals | 46 | 65 | 4 | 18 | 17 |

Source: Field survey (2012). Figures in parenthesis represent percentages.

**Table 3.** Perceived effects of climate change on performances of the herds.

| | SD (%) | A (%) | UD (%) | DA (%) | SD (%) |
|---|---|---|---|---|---|
| Milk production has reduced tremendously due to noticeable change | 66 (47.5) | 59 (42.5) | - | 11 (7.5) | 4 (2.5) |
| Herd mortality is on the increase | 74 (52.5) | 51 (36.7) | - | 15 (10.8) | - |
| New type of disease are noticed | 78 (56.2) | 28 (20) | 4 (2.5) | 25 (17.5) | 5 (3.8) |
| Pre-calving and post calving morality increases | 50 (36.2) | 47 (33.8) | - | 31 (22.5) | 10 (7.5) |
| Abortion in cattle increases | 38 (27.5) | 46 (32.5) | - | 56 (40) | - |
| Abortion in cattle decreases | 91 (65) | 33 (23.7) | - | 12 (8.8) | 4 (2.5) |

Source: Filed Survey (2012). Figures in parenthesis represent percentages.

Savanna may become vulnerable because warming will reinforce existing patterns of water scarcity and increasing the risk of drought. This explains the migration of pastoralists to southern parts of Nigeria and thus increases pressure on land use for cattle and crop production.

## Perceived effects of climate change on performances of the herds

The result (Table 3) revealed that 47.5% of the respondents strongly agreed that the herd's milk production is reducing due to changes in climatic elements. More than half (52.5%) of the respondents strongly agreed that herd mortality is on the increase while 56.2% reported the emergence of new types of diseases. Furthermore, 60% of the respondents agreed that abortion in cattle increases while 40.8% reported incidence of pre- and post calving mortalities in their herds. This might not be unconnected with the quality of existing pasture and the need to cover long distances for grazing under harsh weather conditions. The findings agreed with NRC (2002) that climate change could impact the economic viability of livestock production systems worldwide.

## Livelihood strategies of pastoralists due to climate change

Table 4 summarized the enterprises undertaken by the respondents as their means of livelihood in view of prevailing adverse effects of climate change on livestock production in the study area. The result indicated that 75.5% of the pastoralists engaged in crop farming while 14.23, 15, 9.23, 7.86 and 13.57% engaged in trading, commercial transportation, farm labour, security guard and use of motor-cycle (Okada) for human transportation respectively to supplement the dwindling income from cattle production.

## Pastoralists' reasons for venturing into other enterprises

Table 5 showed pastoralists reasons for venturing into other enterprises in descending order of importance. These include diminishing land for cattle grazing with a mean ranking of 5 using a five point likert- rating scale. Others include poor quality of existing pasture (4.6), inadequate income from cattle rearing to meet family requirements (4.39), land tenure system (3.57) and low cattle productivity (3.55) for diversifying into other enterprises.

These necessitated their venturing into crop production for food and to supplement their inadequate income from cattle production. It can be inferred that the planting of crops by the pastoralists might be suggestive to the farmers that the pastoralists intend to stay permanently on their land. This might be partly responsible for the constant hostilities between the two groups.

**Table 4.** Livelihood strategies of crop farmers and pastoralists.

| Livelihood strategy | Pastoralists N=140 | |
|---|---|---|
| | Frequency | Percentage |
| | 106 | 75.5 |
| | 140 | 100 |
| Trading | 20 | 14.23 |
| Commercial transportation | 21 | 15 |
| Farm labour | 13 | 9.23 |
| Security guard | 11 | 7.86 |
| | 19 | 13.57 |

Source: field Survey, 2012.

**Table 5.** Pastoralists' reasons for venturing into other enterprises.

| Reasons | SA | A | MD | D | SD | Mean |
|---|---|---|---|---|---|---|
| Income from cattle not adequate to meet family needs | 91 (65) | 33 (23.6) | 2 (1.43) | 8 (5.71) | 6 (4.3) | 4.39 |
| Land for cattle grazing is diminishing | 140 (100) | - | - | - | - | 5.00 |
| Pasture quality is becoming low | 115 (82.1) | 14 (10) | 4 (2.9) | 4 (2.9) | 3 (2.1) | 4.60 |
| Low cattle productivity | 97 (69.3) | 29 (20.7) | 2 (1.4) | 7 (5) | 5 (3.6) | 4.14 |

Source: Field survey (2012). Figures in parenthesis represent percentages.

**Table 6.** Chi-square analysis of the relationship between the climatic factors and the performances of herds.

| Variables | Degree of freedom | $x^2$ calculated | $x^2$ tabulated | Level of significance | Comments |
|---|---|---|---|---|---|
| Reduction in milk production | 3 | 52.000 | 7.8147 | 0.000 | Significant relationship exists |
| herd mortality is on the increase | 2 | 20.725 | 5.9914 | 0.000 | Significant relationship exists |
| Declining size of rangeland | 3 | 53.500 | 7.8147 | 0.000 | Significant relationship exists |

Source: Field survey (2011).

### Chi-square analysis of the relationship between the effects of climate change on grazing land and the performances of herds

The result of Chi square analyses (Table 6) established a significant relationship between climate change and declining size of grazing land; herd performances ( milk production, $x^2$ = 52.00, tabulated = 7.8147, P≤0.05; herd mortality, $x^2$ = 20.725, tabulated = 5.9914, P≤0.05). The results confirm the findings of NRC (2002) that lack of prior conditioning of livestock to weather events such as temperature and drought often result to catastrophic losses in the domestic livestock industry. Ambient temperature has the greatest influence on voluntary feed intake. These explain the poor performances of local herds to cope with supply of animal protein required in Nigeria. This also agreed with Amogu (2009) that unfavourable environmental situations hinder livestock production in Nigeria.

## CONCLUSION AND RECOMMENDATION

The study has shown that climate change has reduced grazing land, herds' milk production and increases mortality rate. The pastoralists have diversified into crop production and other enterprises to supplement their income from declining herd population. It was recommended that pastoralists should be encouraged, through extension services, to participate in crop and other enterprises as alternative ways of enhancing the dwindling income from livestock rearing. This in turn will fast track Nigeria's strive for attainment of self-sufficiency in local food production.

### REFERENCES

Adamu B (2008). Keynotes address in Gefu JO, Alawa CBI, Maisamari B, (eds). The future of Transhumance Pastoralism in West and Central Africa. Strategies, dynamic, conflicts and interventions,

Proceeding of International conference on the future of transhumance pastoralism in West and Central Africa held in Abuja, Nigeria.
Ademola A (2012). When neighbours fight over cattle, farms. Nigerian Tribune, April 5, P. 27.
An-Naim AA (2004). Causes and solutions for Darfur. The San Diego Union Tribune. http//www.sigonsandiego.com/uniontrib/20040815/news_lz1e5darfur.html Retrieved 22/05/2012.
Amogu U (2009). Maximizing the animal production value addition chain in Nigeria. Invited presentation at Nigeria Institute of Animal science, Annual General Meeting, University of Calabar, July 28, 2009.
Ayoade JO (2004). Climate Change. Ibadan: Vantage Publishers. pp. 45-66.
Brenjo N (2007). Looking for water to find peace in Darfur. Alert Net blog. http://www.alertnet.org/db/t/b/06/30-100806-1htm Retrieved 22/05/2012.
Building Nigeria's Response to Climate Change (BNRCC, 2008). Vulnerability, impacts and adaptation to climate change in Nigeria. 1, Oluokun Street, Bodija, U, I. P. O. Box 22025, Ibadan, Nigeria. Email: info@nigeriaclimatechange.org.
Heinrich Boel Foundation (2000). Climate Change and Human Right. In New Perspetive quarterly, 17:14-26.
Ingawa S (2005). New Agricultural Technologies Adopted from China. Message Delivered at a Workshop for North –East and North –West. States of Nigeria. Nigerian Tribune, No 13, 714, September 1, 2005 P. 1.
Intergovernmental Panel on Climate Change (IPCC) (1996). Climate change synthesis report. www.ipcc.ch/pdf/assessment -report/a-4/pdf.
Intergovernmental Panel on Climate Change (IPCC) (2007b). Impacts, adaptation and vulnerability: The Working Group II Contribution to the Intergovernmental panel on climate change fourth assessment report. Cambridge University Press.
Ismaila U, Gana AS, Tswanya NM, Dogara D (2010). Cereals Production in Nigeria: Problems, constraints, and opportunities for betterment. Afric. J. Agric. Res. 5(12):1341-1350, 18 June 2010 Available online at http://www.academicjournals.org/AJAR. ISSN 1991-637X ©2010 Academic Journals.
Joseph O (2012). 11 killed, thousands flee Nasarawa State as Tiv, herdsmen clash. The Guardian, March 12, P. 8.
McDowell RE (1980).The influence of environment on physiological functions. In Animal Agriculture. The Biology, husbandry and use of domestic animals, Cole, H. H. and W. N. Garrett (eds.) Second Edition, Freeman and Company, San Francisco. P. 460.
National Bureau of Statistics (2009). Statistical News (http://www.nigerianstat.gov.ng). Retrieved 12/01/2013.
National Population Commission (NPC) (2006).The National Populaion Office, Ilorin Kwara State, Nigeria.
National Research Council (NRC), 2002: Abrupt climate change inevitable surprises. National Academy press, Washington, Dc. National Academy Press.
Olayemi JK (2005). Food Security in Nigeria". Research Report No 2. Development policy centre, Ibadan. 2(32):77-78.
Omotayo AM (2010). The Nigerian Farmer and Elusive Crown, 30th inaugural Lecture, Federal University of Agriculture, Abeokuta, Nigeria. P. 9.
Oyetade L (2007). Desertification in Nigeria (African Agriculture).Text of a lecture delivered at the 38th interdisciplinary research discourse, postgraduate school, University of Ibadan, 11th December, 2007.