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By Ayanda, I. F. , Oyeyinka, R. A. , Salau, S. A. & Ojo, F.
Kwara State University, Malete, Nigeria.

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Keywords : *pastoralist, climate, transhumance, change, nigeria.*

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Perceived Effects of Climate Change on Transhumance Pastoralists in Ogun State, Nigeria

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I. Introduction

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, malnutrition, reduced agriculture productivities, water need and supply, adverse effects on grazing land and pasture quality. Climate change also led to rise in sea level. 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 (BNRCC, 2008).

Author α : Department of Agricultural Economics and Extension Services, Kwara State University, Malete, Nigeria.
E-mail : iayanda@yahoo.com.
Author σ : Department of Agricultural Administration, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.
E-mail : akinoye2009@gmail.com

Climate change as suggested by some researchers could impact the economic viability of livestock prod- uction 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. The potential risk associated with livestock production systems due to global warming can be characterized by levels of vulnerability, as influenced by animal performance and environmental parameters. When combined performance level and environmental influences create a low level of vulnerability, there is little risk (e.g. rate of gain, milk production per day, etc.). However, combining an adverse environment with high performance pushes the levels of vulnerability and consequent risk to even higher levels. Inherent genetic characteristics or management scenarios that limit the animals ability to adapt to or cope with environmental factors also puts the animal at risk. 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.

Climate change is attributable directly or indirectly to human activities that change the composition of the global atmosphere. It emanates from natural climate variability observed over a comparable time period (IPCC, 1996). It is obvious from the definition that climate change is an inherent attribute of climate, which is caused by both human activities (anthro-pogenic) and natural processes (bio geographical). As a result of climate change the pastoralists migrated from the northern part of the country to southern parts of the country including Ogun State. There are 651 pastoral households with about 5,937 people in 28 settlements in Ogun State (Omotayo, 2010). 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, intensification of land use, shifting cultivation with short fallow periods and lack of commitment to investment in long-term land improvement initiatives is capable of compromising the

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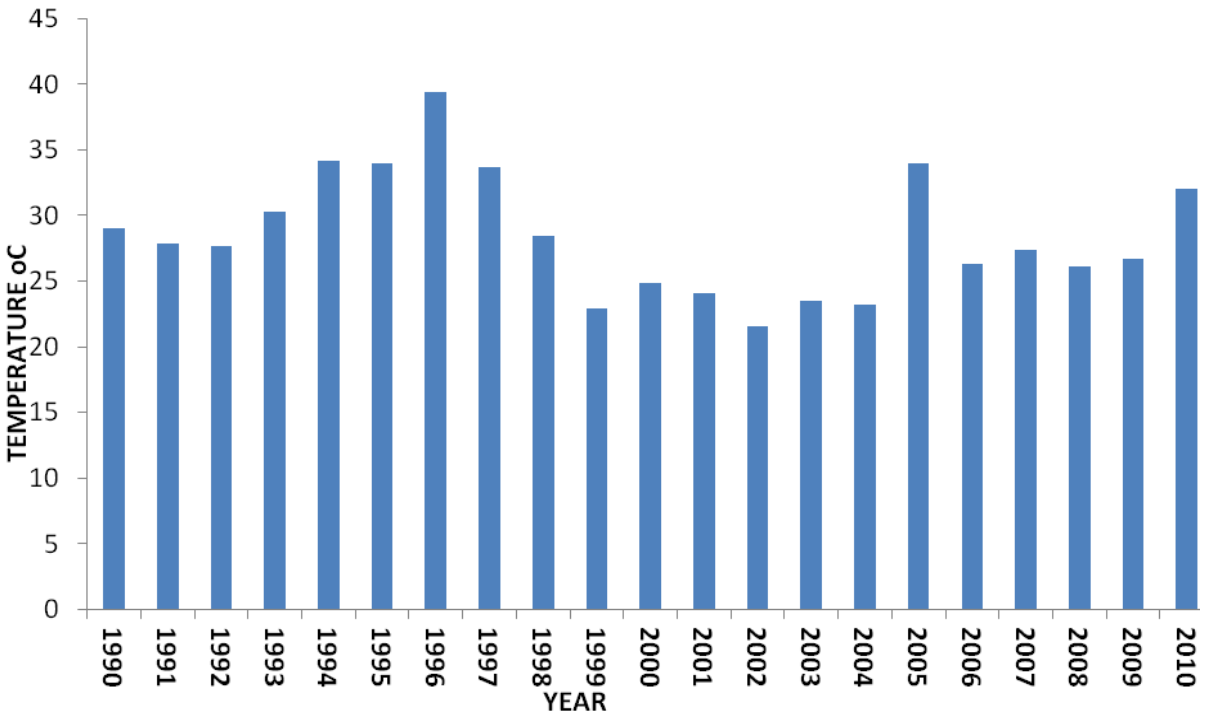
integrity and resilience of the ecosystem (Ayoade, 2004).

II. Problem Statement

Transhumance pastoralism was originally a way of life among communities whose lives and livelihood are in separately intertwined with cattle, goats, sheep and other ruminant species that depend on natural rangeland for grazing resources. Today, 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 dwindling pastoral resources such as open rangelands, wetlands (Fadama land), watercourses and rivers present new challenges to pastoralism (Adamu, 2008).

The bulk of locally produced meat and milk in Nigeria are through the transhumance pastoralists. However, the productivity of their cattle over the years was low partly because of inadequate supply of pasture and water. The situation is aggravated as a result of climate change which exposed the pastoralists and their herds to tougher weather situation especially drought, poor quality pasture, inadequate water supply , risk of contacting disease, pests, conflict between the pastoralists and crop producers over land use. Furthermore, climate change reduced available land for livestock production purposes because of desert encroachment currently moving at 600 metres/annum (or 350,000 hectares per annum (IPCC, 2007). Consequently, pastoralists migrated to the southern part of the country where pasture could be found. In 2008 alone, a total of ₦78.026 billion was expended on milk importation in Nigeria (National Bureau of Statistics, 2009). The reliance on food importation is described as dangerous for the nation's economy (Olayemi, 2005).

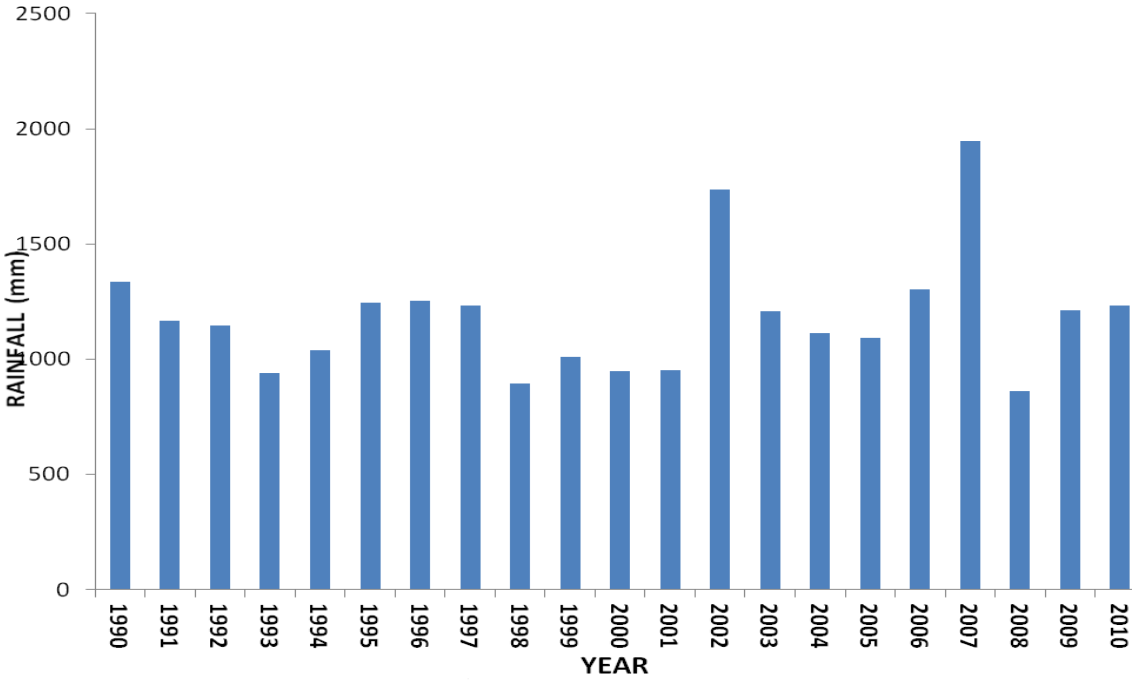
Cattle, sheep and goat performed better (in terms of calving, growth, milk production, etc) within a temperature range of between 10^0C and 20^0C called Comfort Zone". The average temperature range recorded in the study area was throughout the year above the comfort zone (Figure 1) under which these animals can thrive and is capable of predisposing the animals to thermal stress (McDowell, 1980). Furthermore, low and irregular rainfall pattern (Fig, 2). It was only in year 2002 and 2007 that the rainfall recorded was above 1500mm which is just barely adequate to support the growth of tree crops. For most part of the period under review (1990-2010), the rainfall was generally low (below 1000mm). This situation may affect the availability of water and pasture to livestock. Similarly combinations of temperature (Fig.1) and high humidity (Fig. 3) are particularly detrimental to milk production (Smith, 1980).Conducive weather conditions, water and food are important in the physiological processes of these animals.



Source: Ogun Osun River Basin Development Authority, Alabata Road Abeokuta

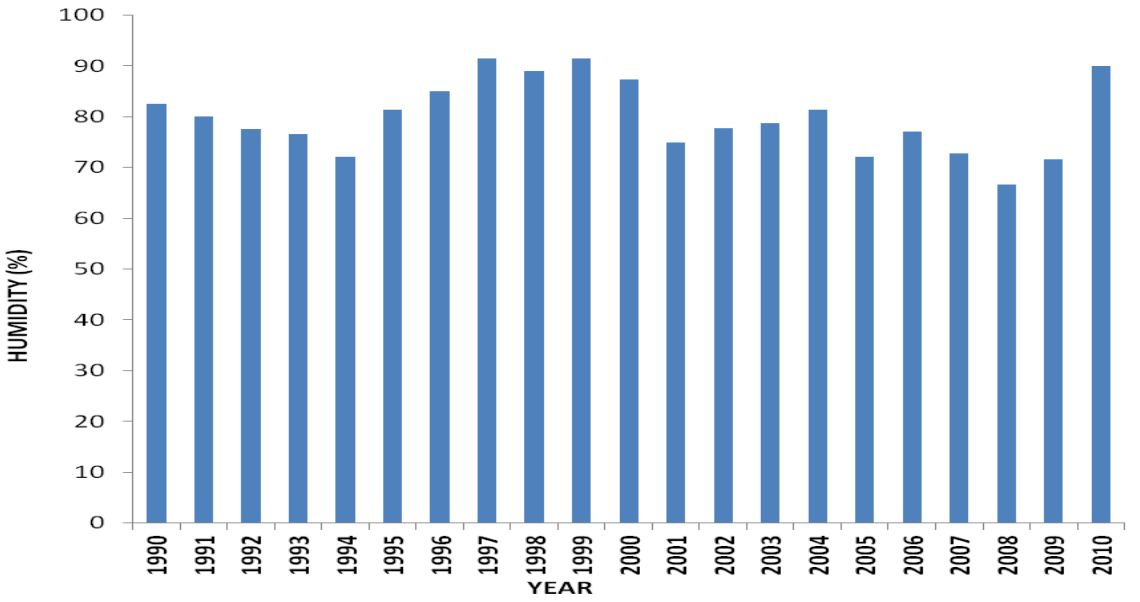
Figure 1 : Average Annual Temperature for Ogun State, Nigeria (1990-2010)

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Source: Ogun Osun River Basin Development Authority, Alabata Road Abeokuta

Figure 2 : Average Annual Rainfall for Ogun State, Nigeria (1990-2010)



Source: Ogun Osun River Basin Development Authority, Alabata Road Abeokuta

Figure 3 : Average Annual Relative Humidity for Ogun State, Nigeria (1990-2010)

Thus, the objectives of the study were to:

(a) examine the socio-economic characteristics of the pastoralists
(b) determine perceived effects of climate change on grazing land,
(c) investigate herds' performance due to climate and
(d) investigate the coping strategies of the pastoralist to climate change.

Hypotheses Testing: The following hypotheses were tested:

(1) There is no significant relationship between socio-economic characteristics and coping strategies of pastoralists to climate change.
(2) There is no significant relationship between adverse changes in climatic factors and milk production of the herds.

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III. Methodology

Study Area : Ogun state was created in Nigeria in the year 1976 alongside with six (6) other states with Abeokuta as its capital. Ogun state lies between longitude 2° 45' and 3° 55'East of Greenwich Meridian and latitude 7° 01' and 7° North of the Equator. It covers a land area of approximately 16,406.226 square kilometers. The State is bounded in the West by the Benin Republic, in the South by Lagos State and the Atlantic Ocean, in the East by Ondo State and in the North by Oyo and Osun States. The population of the state is 3,728,098 comprising 1,847,243 males and 1,880,855 females (NPC, 2006). The state has twenty Local Government Areas LGAs. These include Abeokuta North, Abeokuta South, Ado-Odo/Ota, Egbado North, Egbado South, Ewekoro, Ifo, Ijebu East, Ijebu North, Ijebu North East, Ijebu Ode, Ikenne, Imeko-Afon, Ipokia, Obafemi-Owode, Ogun Waterside, Odeda, Odogbolu, Remo North, Shagamu The State is naturally endowed for food and cash crop production Agricultural production is the major means of livelihood of the people of the state. However there are influx of pastoral Fulanis from the northern part of the country into the state probably due to climate change.

Sampling Procedure and Sample Size: The target population for the study was the pastoral Fulanis in the study area. The study used a multi stage sampling technique to select the respondents. Stage one involved a purposive selection of five LGAs where the pastoralists are mostly located. These include Odeda, Egbado South, Egbado North, Ipokia and Obafemi Owode. The second stage involved the random selection of four Fulanis settlements in each LGAs. The final stage was the random selection of seven Fulanis per settlement to make up a sample size of 140. However, only 120 questionnaires were returned and analyzed.

Data were analyzed using percentages, frequencies and Chi-square statistics.

IV. Results and Discussion

a) Socio-economic characteristics of the pastoralists

Table 1 indicated that 37.50% of the respondents were between the ages of 51-60 years with an average age of 49.8 years. At this age, Ismaila (2010) reported that pastoralists are incapable of handling tedious farming activities such as covering long distances to graze the animals. However it was observed that most respondents looked mal-nourished and older than their age. A possible explanation of their physical appearance might be the long distance covered on daily basis to feed their animals. Majority (90%) of the pastoralists were male with an average of 29.5 years in transhumance pastoralism. The tending of cattle requires long distance travelling on daily basis. This is probably beyond the scope of the female. The result revealed that 58.8% of the respondents were married while 15% of them were widow. This indicates that there is a high mortality rate among the male pastoralists suggesting that pastoralism entails a lot of job hazards. Furthermore, 50.8%, 10.8% and 5% of the respondents had quranic, primary and secondary education respectively. This implies that the Fulanis are mostly adherent of Islamic faith. The average herd size was 21. The frequent search for pasture and water might be the basis for keeping small herd size.

Table 1 : Socio-Economic Characteristics of the Pastoral Fulanis

Characteristics	Frequency	Percentage
Age (Years)		
21-30	11	9.1
31-40	14	11.7
41-50	23	19.2
51-60	45	37.5
61-70	27	22.5
Average	49.8	
Gender		
Male	108	90.0
Female	12	10.0
Marital Status		
Single	19	16.2
Married	71	58.8
Widowed	18	15.0
Divorced	12	10.0
Household Size		
1- 05	87	72.5
6- 10	30	25.0
11-15	3	2.5
Average	6	
Educational Level		
No Formal Education	35	28.4
Adult Education	6	10.0
Quranic Education	61	50.8
Primary Education	13	10.8
Secondary Education	16	5.0
Herding Experience		
1-10	7	5.8
11-20	11	9.2
21-30	38	31.7
31-40	39	32.5
41-50	25	20.8
Average	29.9	
Size of Herds		
1-10	24	20
11-20	37	30.8
21-30	43	35.8
31-40	16	13.4
Average	21	

Source : Field Survey (2011)

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b) The Effects of Climate Change on Grazing Land

Table 2 below summarized the effects of climate change on pasture availability, rainfall pattern, drought and water availability. The results revealed that many (67.5%) of the pastoralists strongly agreed that the pattern of rainfall in recent time affects pasture availability. This implies that the pastoralists would wander a long distance in search of pasture and water. However, 50% of the pastoralists reported that flood occurrence is not a hindering factor or constituting any threat to pasture availability. Also, about 40% of the pastoralists strongly disagreed that drought is not a common occurrence in the state while more than half of the pastoralists (52.5%) strongly disagreed that pasture and water is readily available throughout the year in their domain. This agreed with 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 Savanna may become vulnerable because warming will reinforce existing patterns of water scarcity and increasing the risk of drought in Nigeria and indeed most countries in West Africa. Consequently, more half (56.2%) of the pastoralists cover a far distance to graze their animals.

Table 2 : Perceived Effects of Climate Change on Grazing Land

Perceived effects of climate change	SA	A	U	D	SD	N=120
Pattern of rainfall in recent time affected pasture availability	81 (67.5)*	29 (24.2)	3 (2.5)	4 (3.3)	3 (2.5)	
Prevailing temperature has no effect on the pasture	47 (38.8)	25 (21.2)	0 (0)	45 (37.5)	3 (2.5)	
Flood occurrence hinder pasture growth	30 (25.0)	24 (20.0)	1 (1.2)	60 (50.0)	3 (2.5)	
Drought is not a common occurrence in your location	15 (12.5)	21 (17.5)	6 (5.0)	30 (25.0)	48 (40)	
Pasture is readily available throughout the yea	18 (15.0)	13 (11.2)	3 (2.5)	63 (52.5)	23 (18.80)	
Water is readily available throughout the year	13 (11.2)	10 (8.8)	5 (3.8)	26 (21.2)	66 (55.0)	
You cover long distance to grace your animals	27 (22.5)	67 (56.2)	3 (2.5)	17 (13.8)	6 (5.0)	
Perceived effects of climate change	SA	A	U	D	SD	N=120
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Pasture is readily available throughout the yea	18 (15.0)	13 (11.2)	3 (2.5)	63 (52.5)	23 (18.80)	
Water is readily available throughout the year	13 (11.2)	10 (8.8)	5 (3.8)	26 (21.2)	66 (55.0)	
You cover long distance to grace your animals	27 (22.5)	67 (56.2)	3 (2.5)	17 (13.8)	6 (5.0)	

Source : Field Survey (2011)

*Figures in parenthesis represent percentages.

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c) The Effects of Climate Change on Performances of Herds

The perceived effects of climate change on performance of the herds are shown in Table 3.

Thirty-eight percent of the respondents strongly agreed that the herd's milk production has reduced due to climate change. Also, 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 has also increased. In addition 40.8% of the respondents 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 under harsh weather conditions. This finding agreed with NRC (2002) that climate change 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.

Table 3 : Perceived Effect of Climate Change on Performance of Herds

Perceived effects of climate change	SA	A	U	D	SD	N=120
Milk production has reduced	57 (47.5)	51 (42.5)*	- -	9 (7.5)	3 (2.5)	
Herd mortality is on the increase	63 (52.5)	44 (36.7)	- -	13 (10.8)	- -	
New types of diseases are noticed	67 (56.2)	24 (20.0)	3 (2.5)	21 (7.5)	5 (3.8)	
Pre calving and post calving mortality increases in your location	43 (36.2)	41 (33.8)	- -	27 (22.5)	9 (7.5)	
Abortion in cattle increases	33 (27.5)	39 (32.5)	- -	48 (40)	- -	
Abortion in cattle decreases	78 (65.0)	29 (23.7)	- -	10 (8.8)	3 (2.5)	

Source : Field Survey (2011)

*Figures in parenthesis represent percentages

d) Coping Strategies of the Pastoralists to Climate Change

Coping strategy is an adjustment or self insurance pursued by the pastoralists to ensure future income generation from cattle production and minimize the adverse effects of climate change on cattle productivity. Most pastoralists (65%) engaged in sinking of open wells for the watering of their cattle In addition 57.4% of the respondents reported the use of crop residue. It is important that pastoralists are exposed to technology of hay and silage making and methods of storing crop residue in order to maintain the nutritional value of these feeding stuffs. More than half (58.5%) of the pastoralists' respondents disagreed with the migration option as a way of mitigating the adverse effects of climate change while 52.5% of them resulted to herd size reduction. More than half (57%) of the respondents preferred the cultivation of pasture and legumes for their animal.

Table 4 : Coping Strategies of Pastoralists to Mitigate the Effects of Climate Change

Variable	SA	A	U	D	SD	N=120
Sinking of well	78 (65)*	29 (24.2)	-	10 (8.3)	3 (2.5)	
Production of hay	25 (21.2)	83 (68.8)	- -	9 (7.5)	3 (2.5)	
Storage of crop residue	34 (28.8)	69 (57.4)	- -	17 (13.8)	- -	

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Production of silage	14 (11.7)	18 (14.6)	- -	13 (11.2)	75 (62.5)
Growing of pasture	24 (20)	45 (37.5)	- -	45 (37.5)	6 (5.0)
Sinking of boreholes	37 (31.2)	13 (11.2)	1 (1.2)	48 (40)	18 (15.0)
Migration to conducive locations	39 (32.5)	10 (8.8)	1 (2.2)	48 (40)	22 (18.5)
Reduction of herd size by selling	39 (32.5)	15 (12.5)	3 (2.5)	48 (40)	15 (12.5)

Source : Field Survey (2011)
*Figures in parentheses represent percentages

e) Relationship between the adverse changes in climatic factors and performances of the herds

The result of Chi square analyses established a significant relationship between adverse changes in climatic factors and milk production (x^2=52.00, p≤0.05), herd mortality with (x^2=20.725, p≤0.05), new types of diseases are noticed (x^2=53.500, p≤0.05)) and pre-calving mortality increases (x^2=15.500, P≤0.05) (Table 5). The result confirms the findings of NRC (2002) that lack of prior conditioning of livestock to weather events often results to catastrophic losses in the domestic livestock industry. According to him, combining an adverse environment with high performance pushes the levels of vulnerability and consequent risk to even higher levels. Inherent genetic characteristics or management scenarios that limit the animals ability to adapt to or cope with environmental factors also puts the animal at risk. Ambient temperature has the greatest influence on voluntary feed intake. Most of the local breeds of cattle have reached their peak of production by virtue of their poor genetic make-up and unfavorable environmental situations (Amogun, 2009).

Table 5 : Relationship between Adverse Changes in Climatic Factors and Performances of the Herds

Variables	Degree of freedom	x^2 calculated	x^2 tabulated	Probability	Comments
	3	52.000	7.815	0.000	Significant
Herd mortality on the increase	2	20.725	5.991	0.000	Significant
New type of diseases are noticed	3	53.500	7.815	0.000	Significant
Pre and post-calving mortality increases	3	15.500	7.815	0.000	Significant
Abortion in cattle incre ases	2	1.900	5.991	0.387	Not Sig
Abortion in cattle decreases	3	2.100	7.815	0.552	Not Sig

Source: Field Survey, 2011

In addition, a significant relationship was also estab- lished between selected socio-economic characte- ristics and coping strategies of the pastoralists to climate change (Table 6) Age (x^2=25.375, P≤0.05), marital status (x^2=49.30, P≤0.05) and educational level (x^2=51.200, P≤0.05). This finding confirms the report of Sharada et. al. (2000) that both age and educational attainment are some of the important contributory factors to exposure and adoption of innovations. The youth are highly travelled, venturesome and can take risk, while educational attainment will enable them to access information on animal husbandry practices through the print or electronic media that can assist them to mitigate adverse effects of climate change. The wives can assist the husband in the marketing of animal products while the children can assist in grazing of the animals. The larger the size of the household the ease with which these tasks can be accomplished and innovations are adopted (Rogers, 2003).

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Table 6 : Relationships between the Socio-economic Characteristics of the Pastoralists and Coping Strategies of Climate Change

Variable	Degree of freedom	x^2 calculated	x^2 tabulated	Probability	Comments
Age	4	25.375	9.487	0.000	Significant
Marital Status	3	49.300	7.815	0.000	Significant
Educational Level	5	43.025	12.519	0.000	Significant

Source : Field survey, 2011

V. Conclusion and Recommendations

The study revealed that climate change is not only limited to the northern parts of the country but its adverse effects are noticed on the performance of herds of pastoralists (especially on milk production, herd mortality and incidence of unidentified new diseases) in Ogun State, Nigeria. The coping strategies to mitigate the adverse effects of climate change were inadequate to support better performance of the herd. The willingness of the pastoralists to accept a sedentary way of life through the rejection of transhumance (migration) is a welcome development. This will fast tract their access to extension services and improve on their coping approaches to mitigate the adverse effects of climate change. Therefore, the extension workers should expose the pastoralists to better approaches and coping strategies such as hay and silage making. The pastoralists should cooperate on joint use of resources for production of pasture to meet the food as well as water requirements of their herds. The grazing reserves in the state should be properly developed to encourage the pastoralists to adopt a sedentary way of life. This will enable their children to access education, urban values and mitigate the adverse effects of climate change on their herds.

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