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CLIMATE CHANGE AND SOIL DEGRADATION IMPACT: FARMERS' VIEWPOINTS IN KEBBI STATE NIGERIA.

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ABSTRACT

Understanding climate change and soil degradation impact on global environment is an enormous scientific challenge of the 21st century. Kebbi State is due to consider this challenge because of its low economic development, lack of infrastructure, services and needs for special attention on soil and environment in developing proper agricultural activities. For this, the ultimate aim of this study was to address the impact and causes of climate change and soil degradation in Kebbi State Nigeria. In an effort to collect necessary information, a Verbal Interview (VI) was carried out in rural areas of Bagudo, Birnin Yawuri, Bui, Dirin daji, Gotomo, Kangiwa, Ngaski, and Tondi gada. The results of this study indicated that farmers' viewpoints on the impact of climate change and soil degradation have contemplation in the global climate change and soil degradation perspectives. The opinion of farmers is that the major factors behind climate change and soil degradation impact in the affected areas include deforestation, drought, overgrazing, poor government policy, poor research development, increase population and poverty.

Keywords: Climate change, Soil degradation, Farmers, Interview

INTRODUCTION

Call has been made for more research into the global drivers of African climate and into the detailed consequences at local level (Conway, 2009). Sub-Saharan Africa is due to answer this call because of its low economic development, lack of infrastructure, services and needs for special attention on soil and environment in developing climate change adaptation strategies (Eswaran *et al.,* 1998). Understanding climate change and its likely impacts on global environment is one of the great scientific priorities of the 21st century and responding successfully to them will be a major test for global environmental civilization (David *et al.,* 2008; Trevor, 2009). Climate change impact has led to increase in soil and land problems such as changes in the seasonality of precipitation and a potential increase in the frequency of extreme events to have also potential implications on soil properties and process rates (Parry *et al.,* 2007). Climate change has been linked to degradation of natural resource such as soil inform of erosion, that has received a very high consideration for both in research and environmental policy issues because of its potential impacts on global environmental and soil developments (Dougill *et al.,* 2002; Thomas and Dougill, 2003; Pathak *et al.,* 2005; Engstrom *et al.,* 2008). So far, the result of many studies on climate changes worldwide suggested that climate change is the major driving force of

soil degradation (Devidson *et al.,* 2003; Trevor, 2009; Ameztegui *et al.,* 2010). The IPCC report on working group II (Perry *et al.,* 2007) reported that increased rainfall amounts and intensities will lead to greater soil erosion rates, which are expected to change in response to changes in climate for a variety of reasons including the change in the erosive power of rainfall, changes in plant canopy, change in the litter cover, and changes in land use practices. Indeed, as a result of losses and damages caused by climate changes and soil degradation on global environment (Max *et al.,* 1997; Bationo *et al.,* 2007; Pak Sum Low, 2010), the rapid increasing world population is currently suffering from food crisis that led to the increase in hunger, malnutrition and poverty. Kebbi State will be a good example. The work of Usman (2007) reported that there is need of more information on impact of climate change and soil degradation in northern States of Nigeria including Kebbi State. Meanwhile, environmental crisis due to climate change or soil degradation problems are increasingly alarming and affects almost everyone on the planet (IFAD, 2007). The development and poverty reduction in Kebbi State depends on its ability to conserve, sustain and manage soil resources for agricultural production. Therefore, in this study, the farmer's outlook on the impacts of climate change as liked to soil degradation in dry areas are taken into account in addition to identify the major causes of environmental changes in some local areas of Kebbi State Nigeria.

MATERIALS AND METHODS

Area of study: Kebbi State is located in sub-Saharan West African desert region, bordering the nations of Niger republic to the west and Benin republic to the southwest, and also borders the Nigerian States of Sokoto to the north, Zamfara to the east and Niger to the south. Kebbi State is one of the Sudano-Sahelian zone regions of Nigeria dominated by Hausa-Fulani. The total land area of the State is 36,229 km^2 of which 12,600 km^2 is under agriculture. The State has a total population of 3, 630, 9313 people of which 85% (over 2 000000) are farmers. The major binding factors among the people living in the Sate include the significance of Islamic religious culture, Hausa as a major language of communication and agriculture as a key economic sustainable livelihood.

Verbal Interview (VI): In an effort to collect necessary information on climate and environmental changes in Kebbi State, a Verbal Interview (VI) was carried out in rural areas (Richard, 2007; Martin, 2007). Farmers were selected according to Random Method (RM) introduced by FAO (1997). The respondents include rural farmers, village heads and house heads living in Bagudo, Birnin Yawuri, Bui, Dirin daji, Gotomo, Kangiwa, Ngaski, and Tondi gada local areas of Kebbi State. The types of questions used were mainly on climate change and soil degradation. These questions are: 'Is climate changes?', 'What major environmental degradation it caused' 'Is climate change affect physical environmental condition? And what they believe would happen to their physical environmental condition in the future; Are there any soil changes on your farms? What are these major changes? Have you observed yield reduction? What are the major causes?. Priority was given to forest, vegetation and cultivated lands, which have been affected physically. The total size of the participants in each village was 100 (100 x 8 = 800). The participants were predominantly farmers aged 20 to 70 years old. Individuals were organized in front of district head house to answer the questions early in the morning. Overall, each interview was recorded using pen and exercise book, lasted between 55 and 95 minutes for a period of 2 days in each study area from Saturday to Sunday. This interview was also

repeated for 5 weeks, and the reason behind this is to collect as much information for data accuracy. However, at the end of each interview, the recorded information was then reorganised in another new exercise book and finally documented into the laptop computer for future record and further analysis.

RESULTS

The results of the study are given in Tables 1, 2 and 3.

Table 1: Farmer's perceptions on soil changes after 20yrs of independent 91 – 10

Villages interviewed	20–40 Years old people (33%)	40 – 60 Years old people (33%)	Above 70 Year old people (33%)	Major environmental degradation
Bagudo	29 (4)	31 (2)	30 (3)	Soil erosionD*
B-Yawuri	24 (9)	25 (8)	19 (14)	Deforestation
Bui	31 (2)	32 (1)	31 (2)	Soil erosionD*
Dirin-daji	23 (10)	30 (3)	18 (15)	Deforestation
Gotomo	30 (3)	31 (2)	29 (4)	Soil erosionD*
Kangiwa	33 (0)	28 (5)	31 (2)	Desert/Soil Er*
Ngaski	25 (8)	33 (0)	21 (12)	Deforestation
Tondi-Gada	28 (5)	33 (0)	28 (5)	Gully erosion

Note: Er* means Erosion and D* means desertification. Source: Usman, S. (2013) Field work

The total numbers of persons who reply positively and negatively to the questions were presented in Table 1. The number of negative answer was shown in bracket. Farmers' responds in Bagudo (90%), Bui (94%), Gotomo (90%) and Kangiwa (92%) have complained that soil erosion, desertification and desert encroachment are physically affecting agricultural lands in their vicinities. Farmers' respond to the same question in Birnin-Yawuri (68%), Dirin-daji (71%) and Ngaski (79%) complained much on deforestation as one the major environmental problem in their areas. Farmers in Tondi-Gada (89%) complained much about gully erosion. The two major environmental problems, which have been complained most, by farmers throughout the interview, are soil erosion and desertification; these are two major problems in Bagudo, Bui, Gotomo, Kangiwa and Tondi Gada. The high percentages of farmer's responds by rank were reported in Bui (94%), Kangiwa (92%), Bagudo (90%), and Gotomo (90%) (Table 1).

Table 2: Percentage of rural farmer's response on physical environmental conditions

Year	Vegetation cover (%)	Forest Areas (%)	Cultivated lands (%)	Physical SE* -condition
1975 – 1980	73	88	59	Excellent
1980 – 1985	52	67	55	Excellent
1985 – 1990	45	48	40	Good
1990 – 1995	67	71	58	Pair
1995 – 2000	69	75	63	Poor
2000 – 2005	74	76	73	Very poor
2005 – Date	86	82	85	Abnormal E*

SE* means Soil Environment. Source: Usman, S. (2013) Field work

Table 2 shows the farmer's rejoinders on physical environmental condition in Kebbi State. According to the farmers' viewpoints, the physical environmental condition commences to change in early 90s. Historical events of farmers' outlook on this problem show that, in years 70s, 80s and early 90s, the environment was physically good. However, unacceptable changes have been noticed by farmers in the late 90s to date. Majority of the farmers who participated in the interview (40–88%), have accounted that during the years 1980 to 1990 most of the agricultural lands in Kebbi State are in excellent and goods conditions; most of the lands are fertile and high crop yields were produced. The vegetation cover, forest areas and cultivated lands were all affected.

Table 3: Response of rural farmers on environmental conditions in four village areas

	Kangiwa	Bui	Birnin Yawuri	Bagudo
Q1.	**Are there any soil changes on your farms?**			
Yes	69	58	61	68
No	31	42	39	32
Total:	(100)	(100)	(100)	(100)
Q2.	**What are these major changes?**			
Soil change	E (61)	E (53)	E (47)	E (52)
	D (33)	L (21)	LC (31)	MM (33)
	DE (6)	D (26)	D (22)	D (15)
Total:	(100)	(100)	(100)	(100)
Crop change	PP (77)	PP (83)	PP (91)	PP (93)
	YR (**)	YR (**)	YR (**)	YR (**)
	Xx (23)	Xx (17)	Xx (9)	Xx (7)
Total:	(100)	(100)	(100)	(100)
Vegetation	PD (37)	PD (26)	PD (39)	PD (88)
	VB (61)	VB (43)	VB (56)	VB (**..**)
	Xx (2)	Xx (31)	Xx (5)	Xx (12)
Total:	(100)	(100)	(100)	(100)
Q3.	**Have you observed yield reduction?**			
Yes	83	91	78	87
No	9	3	7	11
Xx	8	6	15	2
Total:	(100)	(100)	(100)	(100)
Q4.	**What are the major causes?**			
Deforestation	17	14	16	21
Poverty	26	21	19	23
Drought	15	13	14	6
Overgrazing	11	9	13	8
Population	6	12	17	17
Government	17	24	11	21
Poor-research	8	7	10	4
Total:	(100)	(100)	(100)	(100)

Note: E: erosion, D: desertification, DE: dessert encroachment, L: leaching, MM: mass movement (of soil particles) and LC: land channels; PP: poor crop performance, YD: yield reduction, Xx: no respond and (**): same response; PD: plant disappearance, VB: vegetation bare, Xx: no respond and (..): same respond. Source: Usman, S. (2013) Field work.

Table 3 highlighted the reactions of rural farmers on environmental conditions in Baudo, Birnin Yawuri, Bui and Kangiwa. It is reported that 60% to 70% of farmers were agreed that the environment has changed. Similarly, they opined that erosion and desertification are the major environmental problems, which have dynamically altered some of the agricultural lands in their localities. According to 80% of the farmers, the environmental components, which were affected, include soil, vegetation and cropping areas. Other factors noted by farmers are leaching, mass movement, surface land channels, poor crop performance, yield reduction, plant disappearance, and poor vegetation cover. The major causes of these problems are deforestation, poverty, drought, overgrazing, increased population, poor government policy, and poor research (Table 3).

DISCUSSION

The ultimate aim of this study was to address the impact and causes of climate change and soil degradation on agricultural soil environment in Kebbi State. The results indicated that soil and soil properties have been changed, and this change was assessed by farmers as formation and development of soil erosion, desertification, dessert encroachment, leaching, mass movement of soil particles, development of gullies or land channels, which have subsequently resulted to poor soil quality, poor crop performance and yield reduction (Tables 1). This finding has comforted very well with previous studies on impact of climate change and soil degradation on agricultural lands (Eswaran *et al.,* 1998; Parry *et al.,* 2007; Bai *et al.,* 2008). Although the present study has differs with these studies in the sense that it only focuses on farmers view rather than projection using the previous climate data record or a practical field assessment. Physically, aridity is one the major climates characteristics in the affected areas and most of land are uncovered characterised by poor vegetation cover and poor soil conditions in recent years (Table 2). The results of these poor vegetation and soil conditions have been related to factors such as deforestation, poverty, drought, overgrazing, population, government and poor-research (Table 3).

As matter of fact, formation of soil erosion, desert encroachment, mass movement of soil particles, leaching and land channels are problems, which have been associated with climate change impact in many cases. Possibly, it is likely that the amount of rainfall, seasonal variation, length of time and unreliability (drought period) are four key factors, which may have put agricultural soil environment of the study areas into poor condition, as farmers perceived the problems in the different direction (Tables 3). These might have been the result of the formation of soil erosion, soil deterioration and environmental changes as perceived by farmers in the study areas. Because the rainfall regimes of this region, have been characterized by high concentrations in a few months, intermittence and violent storms (Put *et al.,* 2004; Bunyamin *et al.,* 2006). Similarly, Mortimore *et al.* (2000) have also attributed environmental changes as perceived by farmers to high rainfall intensity in their project report on relevance of Nigerian farmers' responses to dryland farming systems in India and Southern Africa. And, a typical example of this was also reported by World Meteorological Organization (WMO, 1967) in countries of Algeria, Chad, Pakistan, South Yemen and Sudan. Geographically, these countries shared similar climate and soil environment with Kebbi State. A long dry season (drought) in the study areas is another area of consideration. For example, the phenomenon might affect the low input farmer who in many ways is relying on available natural resources more heavily (Lee and Schaaf, 2006).

CONCLUSION

The outcomes of this study, observed that farmers' viewpoints on the impact of climate change and soil degradation have some contemplations in the global climate change and soil degradation perspectives (Usman, 2013). The results designated that soil and soil properties were changed in form of soil erosion, desertification, dessert encroachment, leaching, mass movement of soil particles, development of gullies or land channels, and subsequently poor soil quality, poor crop performance and annual yield reduction (Tables 1, 2, 3). Correspondingly, the summary report of IPCC (2001) on climate change for policy makers concluded that "the changes which have been observed in regional climate data have affected many physical and biological systems, and there are preliminary indications that social and economic systems have been affected". The physical and biological systems may include soil, forest, vegetation cover and plant/crop biomass, which farmers complained much in this study. Regardless of whatever changes may expect to occur in the future due to climate change and soil degradation impacts, the Kebbi region is likely to face some challenges if the land would continuous to be in poor condition, unprotected and unembellished. The results of this study indicated that farmer's viewpoints on the impact of climate change and soil degradation have contemplation in the global climate change and soil degradation perspectives. The opinion of farmers is that the major factors behind climate change and soil degradation impact in the affected areas include deforestation, drought, overgrazing, poor government policy, poor research development, increase population and poverty.

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