Perception of Climate Variability on Agriculture and Food Security by Men and Women Farmers in Idanre L.G.A, Ondo State. Nigeria.

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Abstract

This paper focuses on how men and women farmers perceive climatic variability in Idanre Local Government Area of Ondo State. One hundred and eighty (180) questionnaires were administered using systematic random sampling on both male and female farmers in the study area. Climatic data on rainfall, relative humidity maximum and minimum temperature were collected for a period of ten years alongside data on crops such as cocoa, cocoyam, cassava, sweet potatoes maize and yam. The descriptive statistical techniques employed to analyze farmers' responses show that climatic variables affect both men and women farmers' productivity. 60% are male while 40% are female. 47% of the respondents perceived climatic variability as delayed in rainfall, 22% perceived it as high temperature, 6% says it is flood, 3% sees it as unusual rainfall while 22% perceived it as undefined season. Although both gender do not have the same adaptive capacity, women (100%) are more vulnerable to the impact of climate change despite the fact that they play an active role in adapting to its impact to secure food in the study area. The regression analysis reveals that 62%, 50%, 66%, 90%, 34% and 32% of the variance in cocoa, cocoyam, sweet potatoes, maize, yam and cassava can respectively be explained by the climatic variables examined. The correlation analysis reveals that rainfall is highly correlated with cocoa (0.534), cassava (0.481) and maize (0.822). Maximum temperature is highly correlated with cocoyam (0.660) and sweet potatoes (0.412). Minimum temperature is highly correlated with all the crops while relative humidity is negatively correlated with all the crops. These affect the farmers' crop yield in the study area. The paper therefore suggests that both genders should grow crops that are more resilient to weather changes and also practice afforestation.

Keywords: Climatic Variability, Agricultural Production, Food Security, Rainfall and Farmers.

Introduction

Generally in agricultural production throughout the world, both men and women play crucial roles in producing; processing and providing the food we eat (FAO, 2008). Agriculture being one of the most weather-dependent of all human activities is highly vulnerable to climate change. Actionaid (2009) confirmed that agriculture contributes to and suffer from negative effects of climate change. This is because farming accounts for 32% of green house gas emissions if deforestation is included. The future event of climate change predicts adverse environmental and socio-economic consequences including frequency and intensity of heat waves, droughts, floods and typhoons; altered ecosystem; reduced output and productivity of the agriculture,

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fishing and forestry sectors, loss of livelihood, food insecurity and diminished supplies; and heightened incidence of certain diseases and pest on people, animals and plants. Poor women and their communities who rely mostly on the land and natural resources for their food, livelihood, fuel and medicine but less equipped to cope with natural disasters and weather variations bear these impacts most (Yocogan-Diano and Kashiwazaki 2009). Climate change will have more severe impacts on women because of gendered norms and weaker socio-economic status vis-à-vis men. Women manage, control and own lesser resources especially land than men so when harvest collapse either because of floods or drought, women have fewer assets to sell to cope with the situations. Women are also main borrowers in agricultural household because they have greater access to micro-credit and are under stronger pressure to bridge resources gaps hence, more women than men fall into chronic indebtedness related to climate induced crop failures as a result of climate change. Anytime there is food shortage from poor harvest linked to weather problems, women are the last to eat in their households prioritizing the food needs of male household members and children over their own. Tologbonse et.al (2010) reported that climate change increases the rate of sickness/infection and reduces family income. The aim of this paper therefore, is to examine the perception of climatic variability by men and women farmers in Idanre Local Government Area, Ondo State. It will identify trends in climatic variables (according to recorded data) 1998-2007. It will examine the impacts of climatic variables on crop production. The rest of the paper will identify the causes of climate change (climatic variability) and the coping strategies that men and women farmers can adopt to ensure food security.

Hypotheses

(1) There are no significant differences between men and women perception of climate change (H_0).

(2) There are significant differences between men and women perception of climate change (H_1).

Climate Change, Food Security and Poverty

Climate is a long term average weather conditions in a place which exercise some controls and effects on agricultural produce either directly or indirectly. However, climate change is any long-term significant change in the “average weather condition” that a given region experience. IPCC (2007), sees climate change as any change in climate overtime; whether due to natural variability or as a result of human activities. According to the WHO (2003) climate change is caused by both internal variability within the climate system and external factors (both natural and anthropogenic). Global climate change is one of the greatest environmental challenges facing the world today.

Essop (2009) opined that minor changes to rainfall pattern (especially coupled with increased severity of droughts and floods) threaten food security. Food security has been defined by FAO not only in terms of access to, and availability of food, but also in terms of resource distribution to produce food and the purchasing power to buy food when it is not produced. The relationship between climate change and food security is a complex one. Climate change affects all four dimensions of food security; food availability, food accessibility, food utilization and food system stability. Increasing frequency of extreme weather events such as flood, droughts, hail and heat waves also affects food security. People who are vulnerable and food in secured are likely to be the first affected.

Extreme climatologically events may also damage infrastructure such as roads, thus preventing people from buying and selling food from the markets and therefore undermines food security. Agricultural–based livelihood systems that are already vulnerable to food insecurity also face risks such as crop failure, new patterns of pest and diseases, lack of appropriate seeds and planting material and loss of livestock. Mannack (2009) reported that southern Africa faced a shortfall of 4million metric tons of maize in 2007/2008 as a result of erratic rainfall where droughts damaged and destroy maize crops in Lesotho, Namibia, Mozambique, Swaziland, Zimbabwe and South Africa. According to IFAD (2009) the number of poor and hungry people has been increasing and the world now faces a major economic downturn. Climate change, growing competition for land and prices volatility for food and input are having a negative impact on rural women and men in developing countries and particularly on the poorer and most vulnerable household.

World Bank statistics show that Nigeria is responsible for about 10% of global emission. Nigeria alone emits 35 million tons of carbon dioxide (CO_2) and 12million tons of methane (CH_4) which has a high warming potential than CO_2.

The consequences of global warming include sea level rise and flooding of the low lying coastal areas, desertification adverse effects on ecosystem and human health with serious implications on women health. In a study carried out by Chimeze and Abiola-Oloke (2009) women in the Niger Delta region of Nigeria are traditionally the end users, collectors and managers of the ecosystem. They account for about 90% of the food production, processing and marketing. They are also responsible for day to day management of their homes, fetching water, firewood and fodders for their families yet the consequences of environmental challenges are most felt by them since they are the principal custodians of the environmental resources. Climate change will mean that the supply of natural resources will be threatened.

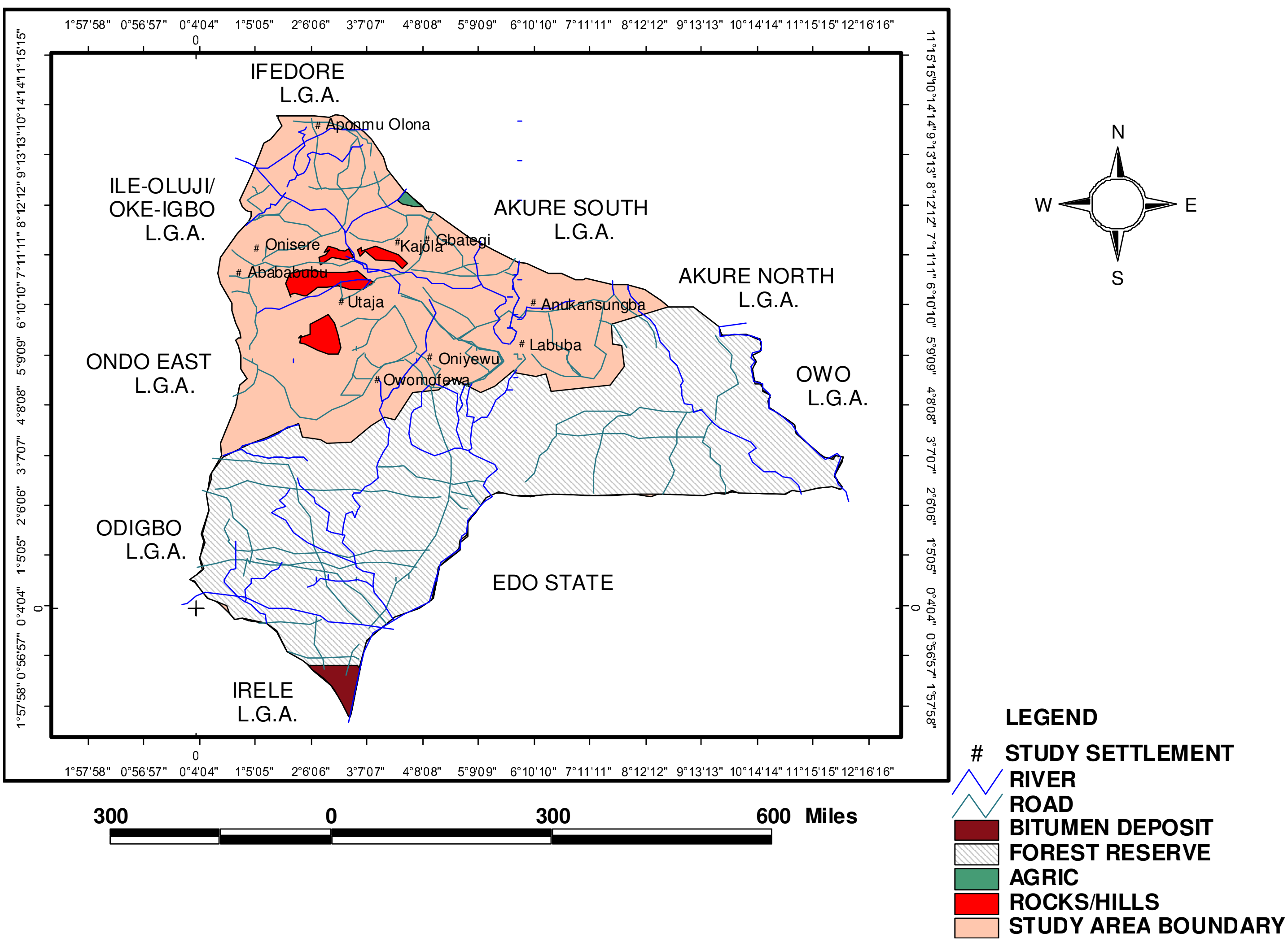

Fig.1: Location Map of Idanre LGAs Showing the Sampled Settlements

Source: Idanre Local Government Headquarter, 2010.

Study Area

The study area is Idanre L.G.A of Ondo State, Nigeria. The Local Government headquarter is in Owena town. The Local Government Area is located between latitudes 06^0 42' and 07^0 42' north and 05^0 00 and 05^0 32' east (fig 1). It is bounded to the north by Akure and Ifedore Local Government Areas. Owo Local Government Area is the boundary at the East and to the West, by Ondo and Ore-Odigbo Local Government Areas. Edo State is the boundary at the South. The land area covers $1832km^2$ (Adegeye, 1993). The area has an average temperature of 78-83^o F between January and July. The area is characterized by forests and rocky hills. It has a population of 129,024 at the 2006 census. The primary activities found here is agricultural production and the common crops grown include cocoa, cassava, cocoyam, sweet potatoes, maize, palm kennel, groundnut among others.

Methodology

A simple random sampling technique was used to select ten settlements from the 245 settlements that make up Idanre local Government Area (LGA) of Ondo state. The sample size consisted of 180 men and women farmers chosen from the ten settlements (Aponmu Olona, Abababubu, Owomofewa iwonja, Kajola, Anukansungba camp Ala, Gbalegi, Utaja, Labuwa, Oniyewu and Onisere (Ofosun) through purposive random sampling procedure.

Both primary and secondary data were used in this study. The primary data include information sourced from administration of structured questionnaire to the rural farmers in the study area while the secondary data (Climatological and agricultural data for ten years) was obtained from Ondo State Agricultural Development Project. The climatological data examined here include rainfall, relative humidity, maximum and minimum temperature while the crops examined include cocoa, cassava, yam, sweet potatoes, cocoyam and maize. Each of the crops was correlated with the climatic variables in order to establish a relationship.

Questionnaires were administered using systematic random sampling method. In all, one hundred and eighty (180) copies of questionnaires were administered altogether and responses were analyzed using descriptive statistical method. The descriptive statistics used include simple percentages; frequency counts, tables and line graph while correlation analysis was employed to assess the relationship between climatic data and crop yield. Multiple regression analysis was used to determine the contribution of the climatic variables to crop yield. Focus group discussion was also organized with the farmers in the local government area to assess their opinions about changes in climatic variables.

Table 1: Climatological Data for 1998-2007

Year	Rainfall (mm)	Maximum Temp^{0}C	Relative humidity	Minimum Temp^{0}C
1998	1090.00	0.00	80.12	0.00
1999	1033.00	30.93	75.55	0.00
2000	1050.00	31.89	81.71	20.32
2001	1004.00	14.78	73.00	9.09
2002	1285.00	30.73	76.91	20.50
2003	1888.00	16.78	58.55	23.42
2004	1291.00	28.08	74.85	19.09
2005	1007.00	30.69	77.65	20.81
2006	1131.00	27.81	68.30	19.57
2007	1294.00	32.13	75.80	20.80

Source: Ondo State Agricultural Development Project

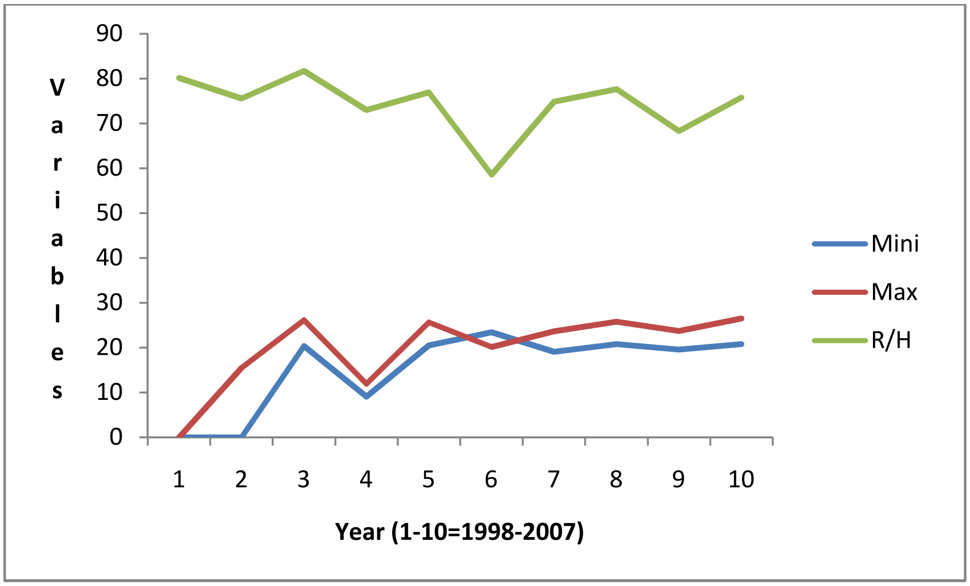

Fig.2: Line graph for climatic variables

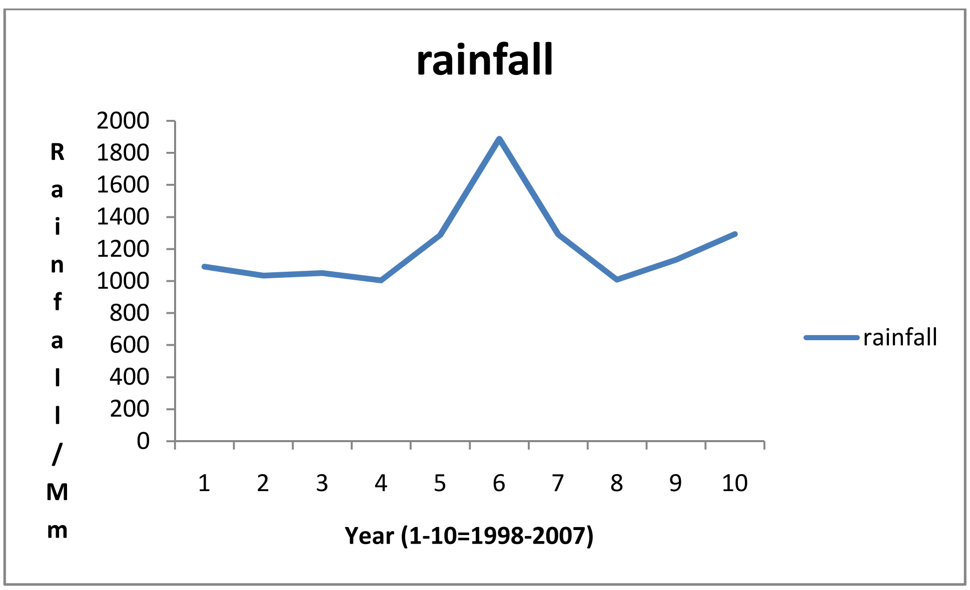

Fig. 3: Line graph for rainfall

Table 1 shows the climatic data over a period of ten years while Figs.2 and 3 show the trend of these climatic variables. According to Ayoade (2004), rainfall is the most important climatic variable in agricultural production so rainfall graph was plotted separately.

Table 2: Crops Production Yield (MT/HA) (1998-2007)

Year	Cassava	Yam	Cocoyam	Swt/potato	Maize	Cocoa
1998	17.298	13.848	7.450	3.560	1.890	27.895
1999	17.017	13.815	7.942	3.685	1.932	31.155
2000	17.079	13.158	8.213	3.778	1.919	24.048
2001	17.520	13.200	7.576	3.688	2.083	45.875
2002	17.489	14.465	7.538	10.577	2.192	54.219
2003	18.420	14.745	7.926	11.000	2.830	64.908
2004	18.400	14.900	8.400	10.938	2.120	67.486
2005	18.943	15.405	8.192	11.158	2.134	57.076
2006	21.113	15.402	8.206	11.198	2.277	60.286
2007	21.916	15.630	8.160	11.000	1.904	45.002

Source: Ondo State Agricultural Development Project

Table 2 reveals that there are variations in the yield of all the crops under study while Fig.4 shows the trend of the yield. Cocoa which is the leading crop has the highest yield in the year 2004, decreased in 2005, increase again in 2006 but decreased in 2007. The changes were attributed to alterations in the climate of the study area.

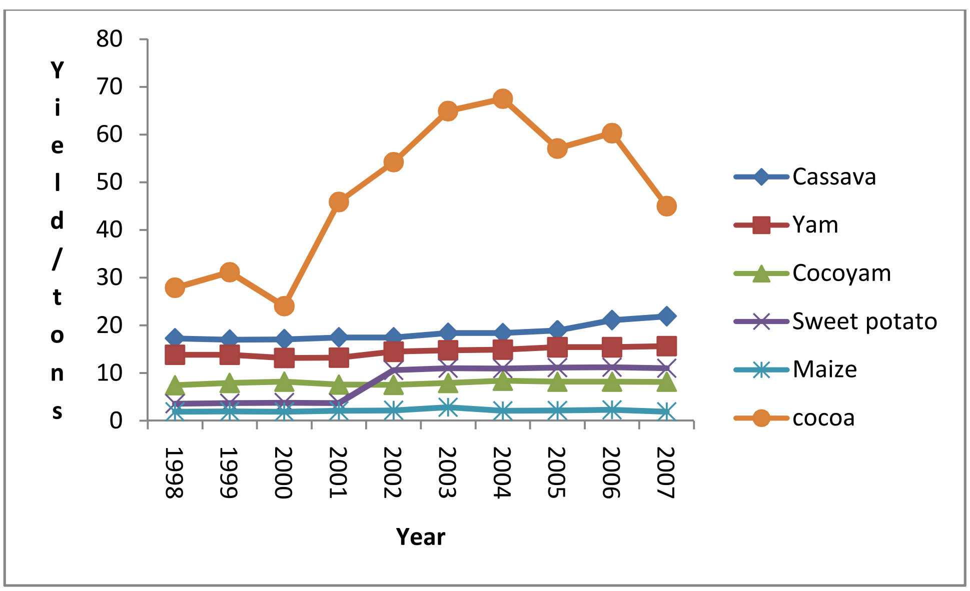

Fig. 4: Line graph showing crop yield (1998-2007)

Table 3: Correlation Analysis of Climatic Variables and Crops

Crops	Rainfall	Maximum Temperature	Relative humidity	Minimum Temperature
Cocoa	.534	.187	-.641	.625
Cocoyam	.043	.660	-.067	.536
Sweet potatoes	-.517	.412	-.443	.778
Maize	.822	-.103	-.907	.501
Yam	.327	.354	-.318	.548
Cassava	.418	-.006	-.418	.602

* Correlation is significant at the 0.05 level (2–tailed).

The correlation coefficient analysis (Table 3) employed for the study reveals that rainfall is highly correlated with maize (.822) and cocoa (.534). Significant correlations exist between rainfall and these crops indicate that a period of high rainfall will be followed by large harvest of maize and cocoa. Rainfall is negatively correlated with sweet potatoes (-.517). Maximum temperature is highly correlated with cocoyam (.660) alone and negatively correlated with maize (-.103) and cassava (-.006). Relative humidity is negatively correlated with all the crops; cocoa (-.641), cocoyam (-.067), sweet potatoes (-.443), maize (-.907), yam (-.318) and cassava (-.418). Minimum temperature is highly correlated with all the crops; cocoa (.625), cocoyam (.536), sweet potatoes (.778), maize (.501), yam (.548) and cassava (.602). The implication of this result is that all the climatic parameters tested affect agricultural yield either positively or negatively.

Gender Perception of Climate Change

If P-value is greater than 0.05, we shall accept the null hypothesis (H_o) and reject the alternative hypothesis (H_1) but if P-value is lesser than 0.05 then we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1).

Analysis of variance was employed to determine if there were significant differences between men and women in terms of the way they perceive climate change. The result shows that there are no significant differences in how men and women perceive climate change because the calculated P-value is 0.751 which was greater than 0.05. Therefore, we accept the null hypothesis H_0 and reject the alternative hypothesis H_1

Socio-economic Characteristics

Table 5 reveals that the population of male farmers (60%) was more than female farmers (40%) in the study area. Also, majority of the farmers (91.6%) fall between the economic active ages (21-50yrs). Furthermore, 87% are married indicating their chances of getting family labour for use on the farm especially among the children, only 13% were widowed. 27% had informal education, 53% had primary education and 20% had secondary education. This signifies low level of education in the area. 90% of the farmers are full-time while 10% are part-time farmers. Also, majority 94% had 1-20ha of land while only 7% had above 20ha of land.

Table 4: Analysis of Variance for Gender Perception of Climate Change

Gender	Sum of squares	df	Mean Square	F	P-value
Between Group	324.000	1	324.000	0.132	0.751
Within Group	4904.000	2	2452.000		
Total	5228.000	3			

Table 5: Socio-economic Characteristics of Respondents

Socio-economic characteristics	Frequency	Percentage
Sex		
Male	108	60
Female	72	40
Total	**180**	**100**
Age in years		
21-30	15	8.3
31-40	60	33.3
41-50	90	50
Above 50	15	8.3
Total	**180**	**100**
Marital status		
Single	-	-
Married	156	87
Divorced	-	-
Widowed	24	13
Total	**180**	**100**

Educational Status		
Informal Education	48	27
Primary	96	53
Secondary	36	20
Tertiary	-	-
Total	**180**	**100**
Farming Status		
Full - time	162	90
Part – time	18	10
Total	**180**	**100**
Size of Farm		
1-5ha	24	13
5-10ha	48	27
10-15ha	66	37
15-20ha	30	17
Above 20ha	12	7
Total	**180**	**100**

Focus Group Discussion

Farmers in the study area were asked to discuss their perception about climate change and their crop production yield. From their discussions, most of them perceived climate change as increase in temperature and inadequate/ excessive rainfall. Some perceived it as flooding while very few just discover that the weather has changed from the way it was before. Majority agrees that human beings are the causes of changes in climatic variables due to increase in population, bush burning and cutting of trees. According to them, cocoa is a major crop in the study area. They indicated that when they started about forty years ago, they were practicing crop rotation at an interval of five years to allow the land to rest, but they cannot do that again because they don't have enough land to do it as a result of increase in population. They also revealed that their production had decreased from what they use to realize some twenty years ago. This is evident from recorded data on cocoa (Table 6) obtained from Ondo State Agricultural Development Project. From the data, the highest yield of cocoa was recorded in 1988 (82,368tons). 67,486tons was recorded in year 2004 and 64,908tons was realized in year 2003, while1998, 1999 and 2000 recorded low yield ranging from 24,048tons, 27,895tons and 31,155tons respectively. What the farmers realized in 1988 was almost twice what they realized in the year 2007 probably as a result of changes in rainfall patterns, temperature, sunshine and relative humidity. This signifies that changes in climatic variables have greater impacts on agricultural production and food security in the study area.

Table 6: Crop (Cocoa) Yield for 20years (1988-2007)

Year	Cocoa (Metric Tonnes)
1988	82,368
1989	56,374
1990	58,869
1991	64,342
1992	40,054
1993	62,166
1994	56,371
1995	43,299
1996	43,900
1997	41,182
1998	27,895
1999	31,155
2000	24,048
2001	45,875
2002	54,219
2003	64,908
2004	67,486
2005	57,076
2006	60,286
2007	45,002

Source: Ondo State Agriculture Development Project, 2009.

Changes in Climatic Variables and Vulnerability to Climate Change

To assess the changes in climate and vulnerability of people to climate change, respondents gave different opinions as shown in Table 7. 80% says changes can be seen in rainfall, 73% attributed it to temperature, 77% opined that it is sunlight while 50% says it is relative humidity. This is in support of Essop (2009) that minor changes to rainfall pattern (especially coupled with increased severity of droughts and floods) threaten food security. Furthermore, the vulnerability of gender to climate change (Table 7) shows that 100% of the women farmers are more vulnerable to climate change while only 20% of men farmers are vulnerable. This means greater proportions of women farmers were vulnerable to climate change than the men farmers

Perception of Climatic Variability

The farmers were asked how they perceive climate change and the results on Table 8 reveals that 47.2% of the respondents perceived climatic variability as delayed in rainfall, 22.2% perceived it as high temperature, 5.6% says it is flood, 2.8% sees it as unusual rainfall 22.2% perceived it as undefined season. This is attributed to the fact that people perceived climate change in different ways. This agrees with the findings of Actionaid (2009) that agriculture contributes to and suffers from negative effects of climate change.

Causes of Changes in Climate Variability

Respondents gave different opinions on the causes of climatic variability. It is as shown on table 8. 50% of the respondents attributed the causes to natural causes, 27.8% says it is caused by anthropogenic activities while 22.2% gave God's annoyance as the cause.

Adaptation to Changes

Respondents were asked how they adapt to these changes in climatic variables (Table 8). 1.7% of the men plant tree, 2.8% practice irrigation, 5.6% prevent bush burning, 16.7% plant cover crops, 2.8% migrate to other areas, 5.6% plant new crops, 11% practice crop rotation 8.3% pray to God and 5.6% had no idea. While 8.3% of women plant cover crops, 17.7 % move to other occupation, 5.6% pray to God and 8.3% had no idea.

Analysis of variance was employed to examine if there are meaningful differences in the way men and women adapt to climate change. The result of the analysis revealed that significant differences existed in the way men and women adapt to climate change in the study area. The calculated P-value is 0.000 (Table. 9) which is lesser than 0.05 therefore, we accept the alternative hypothesis H_1 and reject the null hypothesis H_0.

Table 7: Changes in Climatic Variables & Vulnerability to Climate Change

Variables	**Yes**		**No**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Changes in Rainfall	144	80%	36	20%
Changes in Temperature	132	73%	48	27%
Changes in Sunlight	138	77%	42	23%
Changes in R/Humidity	90	50%	90	50%
Gender	**Vulnerability to Climate Change**			
Men	20	18.5%	88	81.5%
Women	72	100%	-	-

Table 8: Perception of Climate Change & Causes of Changes in Climatic Variables

Perception	**Men**		**Women**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Delayed rainfall	60	33.3	25	13.9
High temperature	14	7.8	26	14.4
Floods	7	3.9	3	1.7
Unusual heavy rainfall	3	1.7	2	1.1
Undefined season	24	13.3	16	8.9
Causes				
Natural Causes	60	33.3	30	16.7
Anthropogenic Causes	25	13.9	25	13.9
God's Annoyance	23	12.8	17	9.4
Adaptation strategies				
Tree planting	3	1.7	-	-
irrigation	5	2.8	-	-
Prevention of bush burning	10	5.6	-	-
Planting of cover crops	30	16.7	15	8.3
Move to other occupation	-	-	32	17.7
Migration to another area	5	2.8	-	-
Introduction of new crops (more resistance species)	10	5.6	-	-
Fallowing and crop rotation	20	11	-	-
Pray to God	15	8.3	10	5.6
No idea	10	5.6	15	8.3

Table 9 : Analysis of Variance (ANOVA) for Gender Adaptive Measures toClimate Change

Gender	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.667	2	0.333	0.000	0.000
Within Groups	0.000	0			
Total	0.667	2			

Source: Computer Output, 2010

Table 10: Regression Analysis for the Crops and Climatic Variables

Crops	R	R2	Standard Error	Regression Coefficient	F	P-value
Cocoa	0.786	0.618	12998.9	158784.6	2.023	0.229
Cocoyam	0.707	0.500	0.316	8.365	1.249	0.398
Sweet potatoes	0.810	0.656	2.972	9.241	2.379	0.184
Maize	0.946	0.896	0.122	4.082	10.721	0.011
Yam	0.585	0.343	0.993	15.846	0.652	0.650
Cassava	0.560	0.313	1.902	28.312	0.570	0.697

Model summary of regression analysis showed that R^2 for cocoa, cocoyam, sweet potatoes, maize, yam and cassava are 62%, 50%, 66%, 90%, 34% and 31% respectively (Table 10). This implies that climate alone explained these percentages of variation observed in the crop yield in the study area. Other factors such as farm management techniques and edaphic factors could be responsible for the remaining percentages.

Strategies to Cope with Climate Change

- Farmers should grow different crops that are more resilient to weather changes and less water.
- Governments throughout the continents should endeavor to educate their population about climate change and environmentally friendly farming practices.
- Policy makers should involve local communities in the debate around climate change.
- Providing irrigation and maintaining flood control require long-term cooperation with farmers or other members of the society.
- Government can encourage agronomic research for development of new varieties better able to withstand the effects of global warming.

Conclusion

The investigation shows that changes in climatic variables, poverty and environmental pressure led to vulnerability of which greater proportion of women farmers are more affected than the men as a result of the multiple significant roles in food security. In view of this, women farmers should be empowered to participate in debates, discussions and decision-making concerning agriculture. Government should implement immediate renewable energy programmes that have health, employment and energy security benefits in the country. Also, both genders should grow crops that are more resilient to weather changes and practice afforestation. These will help to cushion the effects of climate change on agricultural yield/productivity.

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