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THE IMPACT OF CLIMATE CHANGE ON FOOD SECURITY IN NIGERIA: AGRICULTURAL EXPERTS PERSPEVCTIVE

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ABSTRACT

Food availability that will adequately feed the world population is currently under threat due to climate change. Most recent researches focused on past events, when climate change was not pronounced as it is recently. This study examines the perception of Agricultural Researchers and relevant experts on climatic factors affecting food security in Nigeria to proffer suggestions for farmers and policy makers about climate adaptation plan and environmental best practices in Agriculture. Semi-structured interview guides were conducted on 110 Agricultural experts in Agricultural Research Institutes, Faculties of Agriculture of Universities, Ministries of Agriculture and others. Four hypotheses were formulated and tested with the use of inferential statistics, chi-Square at 0.05 alpha level. The result revealed that, most Agricultural Experts agreed that climate change factors affect the four dimensions of food security. Agricultural practitioners were encouraged to adopt environmental best practices that will reduce ozone layer depletion, global warming, encourages afforestation and agroforestry system. Adequate funding for research and innovation to mitigate climate change, intensification of public awareness campaign on factors contributing to climate change and development of a national climate adaptation plan that will support agriculture were recommended to mitigate the impact of climate change on agriculture in Nigeria.

Keywords; Climate Change, Food Security.

INTRODUCTION

Food availability that will adequately feed the world population is currently under threat. An estimated 702 million people have been reported to be living in extreme poverty, while 793 million people are undernourished (Skullerud 2018). Similarly, an estimated 821 million people were reported to be undernourished in 2022, while another hundreds of million more-face occasional hunger and some more live on the edge of hunger (Childress et al 2020). In another report, 733 million people significantly lack access to sufficient calories and 2.8 billion people cannot afford a healthy diet (GHI 2024).

According to the world hunger report, South Asia, is the region facing the most severe food security challenges (GHI 2024). The interconnected challenges of increasing sustainable Agriculture, mitigating and reducing resilience to climate change and increasing food security are particularly pronounced in South Asia (Bandara & Cai 2014). About 600 million South Asians, that directly or indirectly depend on Agriculture live under the World Bank poverty line of less than USS 1.25 per day (Hertel et al 2010). South Africa is one of the continents that is severely affected by extreme weather catastrophes like draught and flood. This situation often leaves Africans poor inhabitants defenceless and the ensuring starvation and livelihood insecurity which are frequently tragic (Fearnhead 2023, GHI 2024).

Climate change has reduced agricultural productivity and growth in Africa by 34% since 1961 (IPCC 2022). In Nigeria, the Ministry of Agriculture 2018 estimated that 65% of the total population is food unsecured, despite the fact that more than half of the population depend on Agriculture. Nigeria has around 95.6 million rural residents that rely on climatically sensitive natural resources for their livelihood, making the country vulnerable to climate change (Ebere & Emodi 2016, World Bank 2019). Nigeria is among the countries with serious hunger level . The country is ranked 110th out of 127 countries in the 2024 Global Hunger Index (GHI) with 28.8 point on the index, (GHI 2024)

The global climate change has affected agricultural activities in most countries of the world. Thus, output has drastically declined and food shortage is on the increase (Eneji et al 2020) Climate change which increases the concentration of atmospheric gases such as carbon (iv) oxide, chlorofluoro carbon among others increases the frequency and intensity of some disasters such as draught, floods, storms, pest and diseases which have the potential to destroy crops, infrastructure and livelihood (Eneji 2020)

Scientists have discovered that earth rising temperatures are responsible for longer and hotter heat waves, more frequent draughts, heavier rainfalls and more powerful windstorms (Macmillan 2016). In Nigeria, the amount of rainfall and high temperatures are important element of climate change (Peter 2012). In this regard, Northeast region is increasingly becoming an avid environment accompanied by fast reduction in the amount of surface water (Ayinde et al 2010). Climate fluctuation exacerbate pests and diseases infection thereby subjecting Nigeria agricultural system to serious stress, threats, shortage of food supplies and increase in the prices of food, this affecting the firm dimension of food security which include: food availability, food accessibility, food utilization and stability of food overtime.

Majority of people in Nigeria lives in rural areas and depend on migratory livestock farming and subsistence agriculture. Nigeria's agriculture contributed more than 22.35% of the country's GDP between January and March 2021 (FAO 2021). Global warming has an impact on Nigeria just like it does on other developing nations and it seriously jeopardize efforts to eradicate poverty and promote sustainable development (Ebele & Emodi 2016).

Global commitment to climate mitigation , which include climate change mitigation and natural resource protection is evident in the United Nations Sustainable Development Goals (SDGs) However, progress toward those goals to date has been limited and Co2 emissions persist at unmitigated rates (Castro and Kuntz 2022).

It has been reported that many cities, national governments, private sector and intergovernmental organizations are making frantic efforts how to mitigate climate change through "net zero" Co2 emissions, communities face more frequent and severe quick on set disasters as well as gradual change in seasons, temperatures and rainfall (Castro & Kuntz 2022). Global temperatures are rising especially in the tropics as is the incidence of extreme cold days and coastal land is disappearing into the sea at rapid rate and reducing available land for agriculture and sustainable development (IPCC 2018). These factors are making the achievement of zero hunger by the target date 2030 appears unreachable (GHI 2024). The global ambitions to climate mitigation and adaptation are outpaced by the rate at which the climate is changing and therefore, to catch up with the rate of change requires innovations, access to climate finance, accelerated and rescaling of adaptation efforts to match climate hazards (United Nations 2018, IPCC 2018, Eneji et al 2020). These can only be achieved when agricultural, environmental and climate experts have adequate and similar understanding of the climate change phenomenon.

Many researches have attempted to study the effects of climate change on food security in different regions of the world. Most of these researchers have discussed climate change in different dimensions. Also, most of the recent research studies mostly focused on events of past occurrence, mostly 10 years ago, when climate change was not pronounced as it is recently experienced. Also, these research studies have not dealt into understanding the impact of climate change from the agricultural experts' point of view. It is therefore, important to investigate the perspectives of agricultural research actors on impact of climate change in order to increase and improve the understanding of the subject matter, adapt and embark on environmental best practice in Agriculture to reduce the impact of climate change. Therefore, the main objective of this study is to assess the impact of climate change on food security from the perspective of agricultural researchers and actors, while the specific objectives are to investigate the understanding of the agricultural experts about the causes of climate change, climatic factors affecting food availability, accessibility, utilization and stability over time and proffer suggestions for farmers and policy makers about climate adaptation plan and environmental best practice in Agriculture

METHODOLOGY

Study Focus

The Agricultural practitioners selected for the study include Lecturers in the Universities, Colleges of Agriculture and Forestry, Research Scientists and Agricultural Technologists of National Agricultural Research Institutions (NARIs), Agricultural experts of the Ministry of Agriculture, State Agricultural Development Programmes, Federal Agricultural Agencies (Non-Research

Oriented), International Agricultural Agencies (IITA) Private Agricultural Farm/Entrepreneurs and Local Government Agriculture Departments.

Sampling Technique, Sample Size and Experimental Design.

Purposive sampling technique was adopted for the study to identify Agricultural Experts that have been involved in Agriculture Research projects for a reasonable number of years and who were able to provide the relevant information for the study. The purposive sampling technique was also adopted to take care of the sample size and avoid data saturation. Data saturation is a situation when the collection of additional new data does not add other information on the issue under investigation (Baker et al 2012, Morse 2000, Mason 2010). Guest et al (2006) has also suggested that (12) twelve interviews are enough for most research studies about understanding the common perceptions and experience among a group of relatively homogenous individual. However, 12 respondents, may not be enough for studies in which the domain of inquiry is diffuse and participants are relatively heterogeneous. In this study the respondents are heterogeneous as they performed different professional roles, and in diverse agricultural institutions with varied mandates. Therefore, , a reasonably large sample size was used for the study.

The Agricultural Experts from the Institutions enumerated above were contacted through semi-structured questionnaire administered via Google form. Information was retrieved from One hundred and ten (110) respondents for final analysis.

The study utilizes both quantitative and qualitative research design. Qualitative data were sourced from the study area. Data collected include respondents' attributes such as job role, institutional affiliation, work experience in number of years and Educational qualification. Other data deals with the perceptions of the respondents with regards to perceived causes of climate change, climate factors affecting food availability, accessibility, food utilization and stability of food over time.

Data Analysis

The data relating to the attributes of the respondents were analyzed with descriptive statistics (frequency and percentage) while the perceptions of the respondents regarding the four dimensions of food security were analyzed with inferential statistics (Chi-square).

RESULTS

Demographic Characteristics, Job role and Expertise of the Respondents:

Descriptive Statistical characteristics of the Respondents showed that most of the respondents (87.3%) had above Master's degree in various discipline of Agriculture. Sixty-five (65) respondents representing 59.1% had PhD, while 31 respondents (28.2%) possessed Master's degree in Agriculture. Only 15 respondents (13.6%) had first degree and Higher National Diploma in Agriculture (Figure 1).

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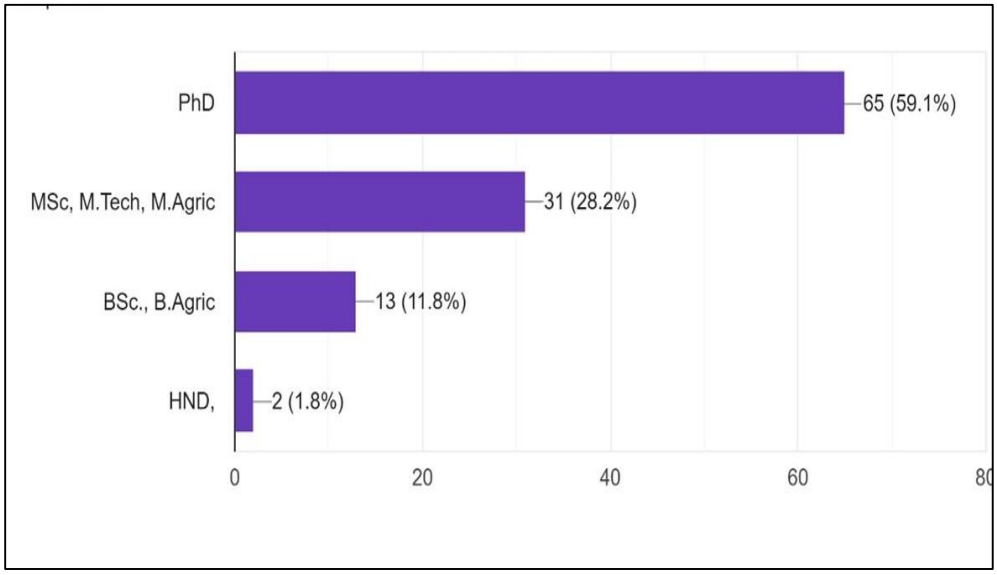

Figure 1: Highest Qualification of Respondents

Similarly, majority of the Respondents (71.9%) are Agricultural experts of the NARIs and the Universities (Table 1). The highest number of the respondents (45.5%) are from the NARIs, followed Lecturers from the Universities which accounts for 26.4% of the respondents, The Experts from Colleges of Agriculture and Forestry accounted for 9.1% of the respondents. Other actors are from State Agricultural Development Programme (7.34%), Private farms & Federal Agricultural Non-Research Oriented Agencies (4.5%) The least respondents are from Local Government, Ministry of Agriculture and International Agricultural Agencies which accounted for 0.94% of the respondents respectively. (Table 1)

Table 1: **Institutional Affiliation of the Respondents**

S/No	Categories of Institutions	Frequency	%
1	Universities	29	26.4
2	National Agricultural Research Institutions (NARIs)	50	45.5
3	Colleges of Agriculture & Forestry	10	9.1
4	Ministry of Agriculture	1	0.9
5	State Agricultural Development Programmes	8	7.3
6	Federal Agricultural Agencies (Non-Research Oriented)	5	4.5
7	International Agricultural Agencies (IITA etc)	1	0.9
8	Private Agricultural Farm / Entrepreneurs	5	4.5
9	Local Government Agriculture Department	1	0.9
		110	100.0

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The result of the work experience of respondents revealed that majority of the respondents had long years of work experience (Figure 2) About 67.3% of the respondents had over 10 years work experience, while 16.4% % of the respondents had between5 and 10 years experience. The respondents that have worked for between one to five years represents 18.2%, and less than one (0.9%) had less than one year work experience (Figure 2)

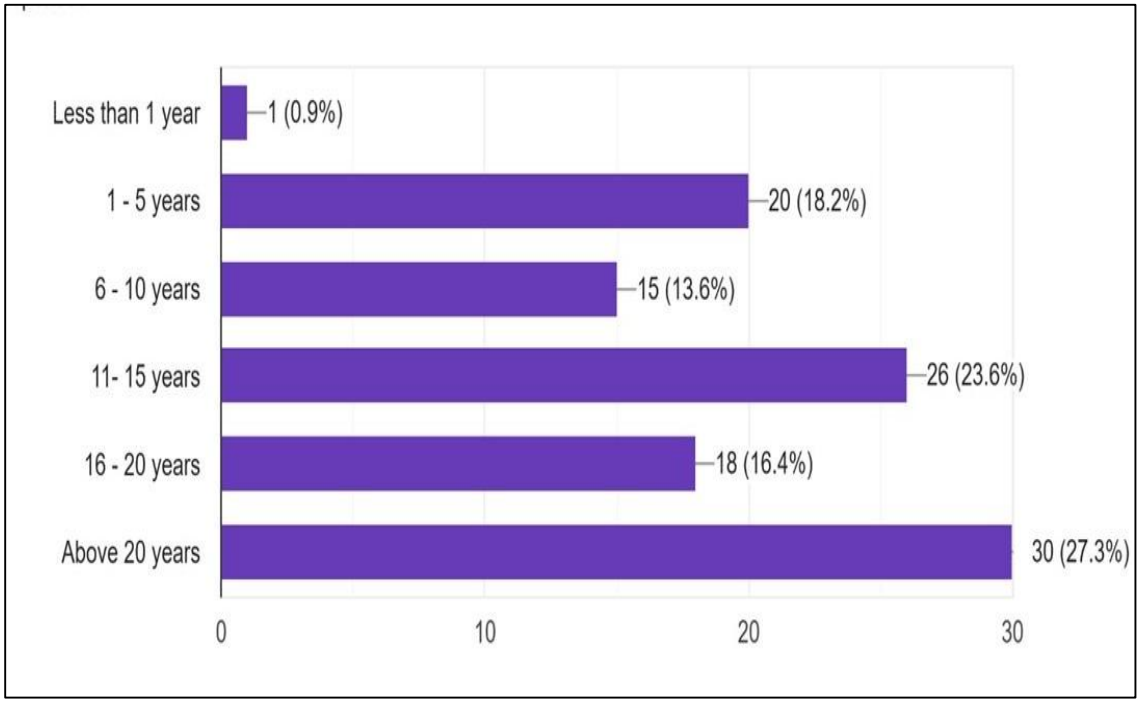

Figure 2: Work Experience of the Respondents

The result of the relevance of the job roles of the Respondents to the study revealed that thirty (30) respondents (27.3%) are experts in the area of genetic improvement and agronomy of crops followed by 18 respondents from Agricultural Extension, rural sociology and farm management, which accounted for 16.4%) of the Respondents. Seventeen respondents from the area of Agricultural value addition, food processing, preservation and human nutrition ranked third and accounted for 15.5% of the Respondents, Soil Scientists constituted 9.1% of the Respondents, while the least percentages of respondents (1.73% and 0%) are from the area of Agricultural Engineering and water management and fresh water management & fisheries (Table 2)

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Table 2. Job Role and Expertise of Respondents

S/No	Categories	Frequency	Percentage
1	Soil Research, Soil management, Soil health etc	10	9.1
2	Genetic improvement and Agronomy of Crops (Arable, Food, Tree, Perennial crops etc)	30	27.3
3	Genetic Improvement and management of Livestock (Ruminants, monogastric, micro-livestock etc	4	3.6
4	Research into Forestry, wood & wildlife	3	2.7
5	Agricultural Value Addition, Food processing, Preservation and Human nutrition	17	15.5
6	Agricultural Engineering and Water management	2	1.7
7	Agricultural Extension, Rural Sociology and Farm management	18	16.4
8	Fresh water management and Fisheries	0	0
9	Agricultural Natural Resources and Conservation (Forest, genetic resources etc)	8	7.3
10	Others	18	16.4
		110	100

Perceived Human-Induced Causes of Climate Change

The descriptive statistics of the respondents on their perceptions about the causes of climate change is presented in Table 3. The result showed that majority of the Respondents agreed that most of the listed variables are responsible for causing climate change. However, the percentage (84.5%) of the respondents in agreement that deforestation causes climate change was the highest followed by Urban & Industrial expansion (82.8%) and accidental and deliberate bush burning (81.0%). Conversely, a total of sixty-two respondents (56.4%) were either indifferent or did not agree that ravages of war cause climate change while 50% of the respondents agreed and 50% did not agree that construction materials contributed to causes of climate change (Table 3). This result shows that human-induced activities had significant impact on climate change.

Table 3: Perceived Human-Induced Causes of Climate Change

		SA	A	I	D	SD	Row Total
1	Consumption of fossil fuel	46 (41.8)	36 (32.7)	11 (10.0)	6 (5.5)	11 (10.0)	110 (100.0)
2	Deforestation	67 (60.9)	26 (23,6)	2 (1.8)	5 (4.6)	10 (9.1)	110 (100.0)
3	Urban & Industrial expansion	45 (40.1)	47 (42.7)	3 (2.7)	4 (3.6)	11 (10.0)	110 (100.0)
4	Overgrazing and harvest of fodder	22 (20.0)	53 (48.2)	15 (13.6)	10 (9.1)	10 (9.1)	110 (100.0)
5	Accidental or deliberate burning of forest	38 (34.6)	51 (46.4)	4 (3.6)	6 (5.5)	11 (10.0)	110 (100.0)
6	Ravages of war	8 (7.3)	40 (36.4)	27 (24.6)	25 (22.7)	10 (9.1)	110 (100.0)
7	Use of chemical in farming	15 (13.6)	51 (46.4)	18 (16.4)	16 (14.6)	10 (9.1)	110 (100.0)

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8	Mining activities	21 (19.1)	54 (49.1)	11 (10.0)	14 (12.7)	10 (9.1)	110 (100.0)
9	Waste burning & air pollution	31 (28.2)	55 (50.0)	7 (6.4)	4 (3.6)	13 (11.8)	110 (100.0)
10	Construction materials	10 (9.1)	45 (40.9)	26 (23.6)	18 (16.4)	11 (10.0)	110 (100.0)

SA: Strongly Agree, A: Agree, I : Indifferent; D : Disagree; SD : Strongly Disagree
Figures in parenthesis are in percentage of the number of respondents

Perceived Climate Factors affecting Food Availability in Nigeria

The total number of respondents and their percentages (strongly agree + agree) that are in agreement with all the listed variable as affecting the food availability is very high, ranging from 65.4% to 83.6%. (Table 4). The chi-square value is 124.903 at degree of freedom (df) of 16 and probability value of 0.000 indicates that these perceived climatic factors significantly affected food availability over time. Also, the probability value is less than the alpha level (0.05) (Table 4), hence the null hypothesis that climate factors such as rainfall, draught, soil degradation among others have no significant impact on food availability is rejected and the alternative hypothesis is accepted

Table 4: Perceived Climate Factors affecting Food Availability in Nigeria

		SA	A	I	D	SD	Row Total	Cal X^2	Df	Prob. Value	Rem
1	Rainfall and Flooding Events	53 (48.2)	36 (32.7)	5 (4.6)	6 (5.5)	10 (9.1)	110 (100.0)	124.903	16	0.000	Significant
2	Drought & Desertification	48 (43.6)	40 (36.4)	7 (6.4)	7 (6.4)	8 (7.3)	110 (100.0)				
3	Use of Chemical in Farming, Fishing & Livestock Causes of Biodiversity Loss	23 (20.9)	49 (44.5)	15 (13.6)	15 (13.6)	8 (7.3)	110 (100.0)				
4	Ravage of Pests & diseases in crops and livestock	31 (28.1)	57 (51.8)	4 (3.6)	12 (10.9)	6 (5.5)	110 (100.0)				
5	Soil degradation and erosion	46 (41.8)	46 (41.8)	3 (2.7)	8 (7.2)	7 (6.4)	110 (100.0)				
6	Increase temperature threat to livestock & Agric yield	28 (25.5)	58 (52.7)	8 (7.3)	7 (6.4)	9 (8.2)	110 ((100.0)				

SA: Strongly Agree, A: Agree, I : Indifferent; D : Disagree; SD : Strongly Disagree
Figures in parenthesis are in percentage of the number of respondents

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Perceived Climate factors Affecting Food Accessibility in Nigeria

The percentage range of Respondents that are in agreement that the perceived climatic factors affected food accessibility is from 40.9% as recorded for Rise in Sea Level to 81,7% recorded under Flood & Drought events. (Table 5) The calculated chi-square (91.030) and 16 degree of freedom at the probability value 0.000 which is less than the chosen level of significant source (0.05), indicates that the null hypothesis which states that "climate factors such as average temperature increase, rainfall rising concentration of Co2 in the atmosphere among others have no significant impact on food accessibility is rejected, and the alternative hypothesis accepted because these factors significantly impact food accessibility

Table 5: Climate factors Affecting Food Accessibility in Nigeria

		SA	A	I	D	SD	Row Total	Cal X^2	Df	Crit Value	Rem
1	Average temperature increase affects food access	12 (10.9)	46 (41.8)	25 (22.7)	18 (16.4)	9 (8.2)	110 (100.0)	91.030	16	0.000	Significant
2	Change in pattern & amount of rainfall	37 (33.6)	52 (47.3)	6 (5.5)	8 (7.3)	7 (6.4)	110 (100.0)				
3	Rising atmospheric concentration of CO2	20 (18.2)	44 (40.0)	19 (17.3)	18 (16.4)	9 98.2)	110 (100.0)				
4	Change in climate variability & extreme events	27 (24.5)	57 (51.8)	9 (8.2)	11 (9.0)	6 (5.5)	110 (100.0)				
5	Rise in Sea Level	12 (10.9)	43 (39.0)	35 (31.8)	15 (13.6)	5 (4.5)	110 (100.0)				
6	Flood & Drought events	37 (33.6)	53 (48.1)	6 (5.5)	7 (6.4)	7 (6.4)	110 (100.0)				

SA: Strongly Agree, A: Agree, I: Indifferent; D: Disagree; SD: Strongly Disagree
Figures in parenthesis are in percentage of the number of respondents

Perceived Climate Factors Affecting Food Utilization in Nigeria

Most of the respondents agreed that with the five perceived climatic factors affecting food utilization in Nigeria. The percentages of the Recipients that agreed with the perceived factors ranged from 63.6% to 80.0% as recorded for Inhabitants of draught-prone area suffers stunted growth and change in rainfall pattern reduces the quantity and quality of Agric products respectively (Table 6). The chi-square value (149.87) and probability value (0.000) are lesser than the alpha level of 0.05. This indicates that the null hypothesis (Ho) which states that climatic factors have no significant impact on food utilization was rejected. This is because climatic factors

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such as draught-prone area, nutrient deficiency in plant causes deficiency in calories dietary intake, change in rainfall pattern among others have significant impact on food utilization

Table 6: Climate Factors Affecting Food Utilization in Nigeria

		SA	A	I	D	SD	Row Total	Cal X^2	Df	Crit Value	Rem
1	Chemical use has negative effect on health	38 (34.3)	47 (42.7)	7 (6.4)	11 (10.0)	7 (6.4)	110 (100.0)	149.87	16	0.000	Significant
2	Inhabitants of draught-prone area suffers stunted growth	26 (23.6)	44 (40.0)	16 (14.5)	19 (17.3)	5 (4,5)	110 (100.0)				
3	Nutrient deficiency in plant causes deficiency in calorie dietary intake	29 (26.4)	52 (47.0)	11 (10.0)	11 (10.0)	7 (6.4)	110 (100.0)				
4	Increases under nourishment, stunting, wasting and mortality in Children	25 (22.7)	56 (50.9)	14 (12.7)	8 (7.3)	7 (6.4)	110 (100.0)				
5	Change in rainfall pattern reduces the quantity and quality of Agric products	40 (36.4)	48 (43.6)	7 (6.4)	6 (5.5)	9 (8.2)	110 (100.0)				

SA: Strongly Agree, A: Agree, I : Indifferent; D : Disagree; SD : Strongly Disagree

Figures in parenthesis are in percentage of the number of respondents

Perceived Climate Factors affecting Food Stability in Nigeria

Result obtained on perception of respondents towards climatic factors affecting food stability in Nigeria shows that Table 7 shows that most of the respondents agreed with all the perceived factors except for two factors namely: High Co2 levels has been associated with reduce protein & nitrogen content in Alfafa and soybean plants and Marine diseases outbreak has been linked to climate change, that were marginal. The result also shows that chi-square value (121.438) at 16 degree of freedom (df) has probability value of 0.000. This value was less than the alpha level (0.0). Therefore, the null hypothesis that climatic factors have no significant effect on food stability in Nigeria was rejected and the alternative hypothesis which states that climatic factors such as high Co2 level, severe warming, flood and draught, marine disease outbreak among others significantly affects the four dimensions of food security.

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Table 7: Perceived Climate Factors affecting Food Stability in Nigeria

		SA	A	I	D	SD	Row Total	Cal X^2	Df	Crit Value	Rem
1	Severe warming, food and draught may reduce yield	45 (40.9)	48 (43.6)	6 (5.3)	3 (2.7)	8 (7.3)	110 (100.0)	121.438	16	0.000	Significant
2	High Co2 levels has been associated with reduce protein & nitrogen content in Alfafa and soybean plants	13 (11.8)	42 (38.2)	39 (35.5)	7 (6.4)	9 (8.2)	110 (100.0)				
3	Draught may threaten pasture and feed supplies and reduce the amount of quality of forage available for grazing livestock	44 (40.0)	48 (43.6)	8 (7.3)	3 (2.7)	7 (6.4)	110 (100.0)				
4	Climate change may increase the prevalence of parasite and diseases that affect livestock and crops]	40 (36.4)	48 (43.6)	10 (9.1)	6 (5.5)	6 (5.5)	110 (100.0)				
5	Marine diseases outbreak has been linked to climate change	14 (12.7)	42 (38.2)	40 (36.4)	7 (6.4)	7 (6.4)	110 (100.0)				
6	Change in temperature & seasons can affect the timing of production and migration in fishes	28 (25.4)	56 (50.9)	16 (14.5)	4 (3.6)	6 (5.5)	110 (100.0)				
7	Increase in Co2 may increase the productivity of pastures but may also decrease their quality	14 (12.7)	55 (50.0)	28 (25.5)	7 (6.4)	6 (5.5)	110 (100.0)				
8	Under condition of poor water availability plant experiences water stress and cells lose turgor resulting in plasmolysis, short become, flaccid and	38 (34.5)	47 (42.7)	15 (13.6)	5 (4.5)	5 (4.5)	110 (100.0)				

	leaves wrinkle and wilt or fall										
9	Reduction in soil nutrient decreases Agric yield	58 (52.7)	34 (30.7)	7 (6.4)	4 (4.5)	7 (6.4)	110 (100.0)				
10	Climate change reduces the daily calorie intake in household	23 (20.9)	41 (39.3)	25 (22.7)	13 (11.8)	8 (7.3)	110 (100.0)				

SA: Strongly Agree, A: Agree, I: Indifferent; D : Disagree; SD : Strongly Disagree
Figures in parenthesis are in percentage of the number of respondents

DISCUSSION

Education is an important factor in the understanding of climate change and its impacts on food security. It increases awareness about the effect of climate change and necessary mitigation and adaptation measures. Expert opinion stimulates intellectual debate on any matter because it drives a logical and reproducible agenda. It has been a known fact that considerable uncertainty surrounds projections of climate change and its ecological consequences (Javeline, et al, 2013), The respondents in this study are largely personnels that have attained higher degree in the field of agriculture, with long years of experience, hence qualified to be accepted as experts in the field of agriculture. This agrees with Grenier (2021) findings, that factors such as duration, relevance, experience, quality of experience and career progression are good yardstick to measure expertise. This gives the study a high degree of richness, reliability and credibility. Having varied number of years in Agricultural Research from different regions on varied job roles allowed the researcher to have more control and access to rich information about climate change and its impact on Agricultural production and the four dimensions of food security.

The significant impact that all the human-induced factors listed in this study are responsible for climate change that is reported in this study agrees with the findings of Anderson 2017 and IPCC 2021. They have also observed that enormous increase in the emission of greenhouse gas Co2, methane and nitrous oxide due to burning of coal and fossil fuel and deforestation are the main drivers of climate change.

Also, the result obtained in this study that climatic factors, such as rainfall and flooding event, draught, Co2 concentration in the atmosphere, soil degradation and erosion among others have significant impact on food availability is in tandem with Eneji et al 2020 who observed that average rainfall and Co2 concentration in the atmosphere negatively affect food availability. This may be attributed to the fact that rainfall and CO2 will have effect on temperature and precipitation patterns, which will in turn alter the length and timing of growing seasons, water availability, soil

health, pests and diseases infestation and many other factors that has direct impact on crop production.

Similarly, whatever affects food availability, will have direct effect on food accessibility. The climatic factors such as average temperature increase, rising concentration of Co2, climate variability among others which significantly impacted food accessibility in this study is in line with the report of IPCC 2018 which stressed the impact of global warming on climate change and has emphasized the strengthening of efforts to mitigate the global threats of climate change, through sustainable developments, which will reduce poverty among resource poor rural dwellers.

The use of chemicals in agricultural practices, draught-prone area, concentration of Co2 in oceans, polar-ice melting among others, reported to have significant impact on food utilization is a confirmation of the report of U.S EPA (2015) that observed that when co2 is absorbed by oceans, it results in ocean acidification which reduces the size and abundance of Shellfish and eventually to changes on price of consumers. Also, the study by GH (2024) asserted that inhabitants of draught prone area have been absorbed to suffer under-nourishment, stunted growth and mortality in children.

Finally, the result in which, climatic factors such as severe warming, Co2, draught among others significantly and negatively impact food stability overtime in this study is expected because food stability is largely dependent on such climatic factors, that has high impact on acidity and alkalinity levels of food. This indirectly affects growth of micro-organisms, spoilage, storage and stability of food availability. This is also confirmed in Childress et al 2022 report that stressed that these factors can reduce fruit set, impaired produce quality and increase yield loss and waste. Also, WMO 2021 observed that global warming makes large area of Africa inhabitable and can cause disaster for human health and food security.

Conclusion and Recommendations

Agricultural experts significantly agreed that climatic factors have significant impact on the four dimensions of food security. The detailed understanding of the climatic factors affecting food security through subjective new points of experts in agriculture can therefore be used encourage agricultural practitioners to adopt environmental best practices that will reduce activities that causes ozone layer depletion, reduces global warming, encourages afforestation and agroforestry system.

It is hereby recommended that more fund be channeled towards research and innovation to mitigate climate change, while intensifying public awareness campaign on factors contributing to climate change. It also becomes important to develop a national climate adaptation plan, such as construction of irrigation scheme to support agriculture.

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