

Investigation into the Methods of Building Climate Resilience in Agriculture by Farmers in Delta State, Nigeria

Ojiako Edith Obiageli, Ph.D¹

eoojiako@yahoo.com

Eze Maryann²

ezeogochukwu2015@gmail.com

Olaroye Rose³

olaroyeroseline1@gmail.com

^{1,2,3}Department of Agricultural Education

Federal College of Education (Technical) Asaba, Delta State, Nigeria.

Abstract

Climate change is having devastating impact on agriculture, lives and livelihood of farmers and rural communities across the globe. With extreme weather events like severe droughts, floods, hurricane, desertification etc, many farmers are facing a dire situation. This study set out to find out the vulnerabilities/challenges facing farmers as a result of climate change, identify the mitigation and adaptation strategies for building climate resilience in agriculture by farmers in Delta state. Semi-structured interview schedule was used in collecting data from 400 farmers across the state. The data was analysed using mean and simple percentage. Among the findings were that farmers are facing serious threats/challenges such as one circle/season of food production, absence of dry season production; decline in soil fertility, low yields; increased pests and diseases attack; high cost of production due to weather stress etc. It is also found out that mitigation strategies (actions to reduce Greenhouse gases (GHGs) include Assisted Natural regeneration (ANR) to retore degraded lands through tree planting./ afforestation; climate index-based insurance policy to help farmers mitigate climate-related risks. The adaptation strategies (action that help offset the effects of climate change will help farmers adjust and modify their production processes include: optimizing irrigation schemes; switching to varieties and breeds resistant to heat, drought and salinity; change in planting periods; integrated pest/fish production/management etc. The way forward to resilience building in farming include adoption of (Climate-Start Agriculture (CSA) and other agroecology concepts; contract farming practices to strengthen grower associations, prioritization of genetics to develop local breeds that are more resilient to climate change etc. Among the recommendations made was that concerted efforts to be made by the stakeholders to move the country away from one circle of food production by adopting the relevant innovations and technologies.

Keywords: Resilience, Climate-Start-Agriculture, Mitigation and Adaptation.

Introduction

Climate changes linked to global warming are already having a devastating impact on the lives and livelihoods of farmers and rural communities across the country. Current climate projections suggest this impact will worsen. Reducing agriculture's vulnerability and increasing productivity in a sustainable way is the challenge that lies ahead for farmers.

As the climate changes, agriculture needs to transform so that it becomes more profitable sustainable and resilient. Building resilience in agriculture is critical not only to protect smallholder farmers, who account for a large share of vulnerable and food insecure populations in Nigeria, Delta State inclusive, but also to ensure food and nutritional security for entire populations of the country. The good news is that innovative approaches are being developed to meet this challenges. One of the approaches, Climate-Smart Agriculture (CSA), aims to increase farm productivity and incomes in a sustainable manner, enable farmers to adapt and build resilience to climate change and where possible, reduce greenhouse gases (GHG) emissions

Thorp (2015) defined climate smart agriculture (CSA) as agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes GHGS (mitigation) and enhances achievement of national food security and development goals. A national imperative defines resilience as the ability to prepare and plan for absorbs, recover from and more successfully adapt to adverse events (Olaopa, 2021). Resilience enables a state to build into her development framework institutions, dynamics and structures that both anticipate and preempt disasters.

The smallholder farmers and producers who face the hard realities of the impacts of climate change on their livelihoods will need practical solution that work for them and their families business as usual is no longer an option for agriculture. Greater resilience must be built by combining sound ecological principles with improved production techniques (Hailu, 2013)

Statement of the Problem

The Nigerian meteorological agency (NIMET) recently warned Nigerians to prepare for a future with more hot days, warm nights and heat waves because of past and present emissions. This preparation will require smart adaptation strategies and engaging in climate resilient practices to cope with the damage that has been done.

This warning is coming in the heels of ActionAids report of 2019 that over one and a half billion people worldwide are on the brink of climate driven food crisis. Every rural community surveyed across Africa, Asia and the Americas said erratic and extreme weather was crippling their ability to feed themselves.

In Nigeria, the combined effects of armed conflicts, COVID-19 pandemic and climate change have been ascertained as factors that would inevitably dragdown agricultural output. It is against this backdrop that Kafeero (2021) recently stated that an estimated 9.2 million Nigerians from sixteen (16) states and the Federal Capital Territory face food insecurity. The Global Network Against Food Crises (GNAFC) had earlier expressed the same grim picture of food security situation in Nigeria that needs to be addressed to avert looming hunger and starvation in the country.

Farmers need to adapt to climate change while maintaining or increasing food production. At the same time, they need to adopt practices which reduce agricultures climate footprint. The answer lies in the practice of climate smart agriculture (CSA). This approach seeks to help farmers increase food production while becoming more resilient to climate change and reducing Greenhouse Gases (GHG) (Hailu, 2011; Pye-smith, 2011). CSA will help in achieving the triple goal of increasing food production, helping farmers to become resilient to climate change and reducing emissions (Thorp, 2015). To cope with the challenges posed by climate change, farmers must build resilience

by combining sound ecological principles with improved production techniques. This paper therefore sought to investigate the methods of building climate resilience in agriculture by farmers in Delta State.

Objectives of the study

The goals of this study was to investigate the methods of building climate resilience in agriculture by Delta State farmers. Specifically the study determined

- Farming communities vulnerabilities to climate change
- Mitigation strategies in place for resilience building
- Adaption strategies for resilience building
- The way forward to sustainable productive, equitable and resilient agriculture.

Research design

The research was a survey study. A survey design involves gathering information from a sample or relevant population that is or relevant population that is familiar with the ideas relating to the objectives of a study. In this study, survey was suitable design that helped to get information from farmers using semi-structured interview schedule. They are in the best position to state what their vulnerabilities are as a result of the climate change, mitigation and adaptation measures in place and the best way forward to building climate resilience in their agriculture

Population and sample

Population of this study comprised of farmers in Delta State.

However a manageable representative sample was drawn from one-third of the twenty (25) Local Government Area of the state that is from eight (8) local Government Areas.

Purposive sampling technique was used in which only known farming communities were used. For a sizeable sample, fifty (50) farmers were purposively chosen from each of the eight (8) local Government Areas making it a total of 400 farmers, who made up the population of the farmers.

Data Collection and Analysis

Oral interview schedule was used to elicit the responses of the farmer on the issues at hand. The collected data were analysed using simple mean and percentage. For acceptance of any response, any one with a mean value of 3.5 and above were accepted as very useful/highly possible/very important while those below 3.5 were rejected. Again, acceptable level of data analysed using percentage was fifty percent (50%)

The study was carried out between January and April 2021.

Result Presentation and Discussion

Table 1: Percentage distribution of background information of these farmers

S/N	ITEM	SUB-ITEM	NO OF RESPONDENTS	PERCENTAGE (%)
1	Location of farm	Rural	260	65.00
		Sub-urban	88	22.00
		Urban	52	13.00
2	Gender	Male	180	45.00
		Female	220	55.00
3	Age Group	10-20yrs	20	5.00
		21-30yrs	120	30.00
		30yrs ⁺	260	65.00
4	Years of farming	Below 5yrs	-	-
		5-10yrs	30	7.50
		11-15yrs	40	10.00
		16-20yrs	65	16.25
		21-30yrs	125	31.25
		30yrs ⁺	140	35.00
5	Professional Background	Trained	80	20.00
		Untrained	320	80.00
6	Educational level	Nene/Initial	44	11.00
		Completed Pri.	82	20.55
		Some Sec. Edu.	36	9.00
		Completed Sec. Edu.	105	26.25
		Non Uni. Tert.	55	13.75
		Some Uni Edu. Completed Uni	3642	9.00
7	Type of farmer	Crop farmer	220	55.00
		Fish farmer	32	8.00
		Animal farmer	44	11.00
		Mixed farmer	104	26.00
8	Scale of operation	Small	320	80.00
		Medium	50	12.50
		Large	30	7.50
9	Who do you work with	Family	102	25.50
		Friends	48	12.00
		Labourers	201	50.25
		Church numbers	9	2.23
		Alone	40	10.00
10	System of farming	Extensive	168	42.00
		semi-intensive	72	18.00
		intensive	160	40.00

From the data presented above, it is seen that majority of the farmers are old men and women, living in the rural areas. Many of them are above 30years of age (65percent). The findings also revealed that majority of the farmers are untrained (80 percent), subsistent/small scale farmers. These rural poor farmers feed the country, with ancient practices that harm the soil, without meaningful assistance from relevant government agencies.

The situation is worrisome considering the crippling effects of climate change that is making farmers across Africa, Asia and the America unable to feed themselves because of erratic and extreme weather events.

Percentage responses of table 2: Climate change challenges/vulnerabilities

S/N	Challenges/vulnerabilities	Response	No of respondent	Percentage
11	Crop farmers: Decrease in annual and seasonal rainfall	Yes No	220 -	100.00 -
12	Erratic weather patterns and more intense rainfall/excessive rainfall	Yes No	220 -	100.00 -
13	Frequent extreme weather events e.g heat waves, storms floods, droughts	Yes No	165 55	75.00 25.00
14	One circle/season of food production and shift in planting dates	Yes No	162 58	73.64 26.36
15	Absence of dry season crop production	Yes No	130 90	59.09 40.91
16	Loss of available land due to coastal erosion	Yes No	36 184	16.36 83.64
17	Decline in Soil fertility	Yes No	140 80	63.64 36.36
18	Poor crop harvests/low yields	Yes No	140 80	63.64 36.36
19	Poor quality of processed and stored products	Yes No	136 84	61.82 38.18
20	Increase insect vectors and viruses due to lower relative humidity	Yes No	176 44	80.00 20.00
21	Increased bacterial and fungal infections due to higher relative humidity	Yes No	188 32	85.45 14.55
22	Soil erosion/flood disasters in the farming and riverine communities that destroyed thousands of farm lands	Yes No	36 184	16.36 83.64
23	Loss of income/livelihoods because of the floods and other disasters	Yes No	90 130	40.91 59.09
24	Poor road network/inaccessibility	Yes No	180 40	81.82 18.18
25	Land degradation/deforestation as a result of wild/bush fires	Yes No	140 80	63.64 36.36
26	2. ANIMAL FARMERS: Poor growth of animals due to heat-	Yes	44	100

	induced stress	No	-	-
27	Poor animal products quality due to reduced water availability	Yes No	36 8	81.82 18.18
28	Changes in availabilities quality and prices of fodder and animal feeds	Yes No	44 -	100 -
29	Poor feed conversion and reduced milk production in the dairy sector	Yes No	10 34	22.73 77.27
30	Drop in egg production in the poultry sector	Yes No	30 14	68.18 31.82
31	Higher mortality and reduced quality in poultry	Yes No	30 14	68.18 31.82
32	Increase in pests, diseases and parasites attack of products due to changes in relative humidity	Yes No	40 4	90.91 9.09
33	High cost of production due to the weather stress	Yes No	44 -	100 -
34	3. FISH FARMERS Low/poor fish harvests due to increasing ocean water temperatures and fish migration	Yes No	10 22	31.25 68.75
35	Death of fish due to acidification and changing water currents and water pH	Yes No	10 22	31.25 68.75
36	Salt water intrusion into rivers and lakes due to rising sea levels	Yes No	10 22	31.25 68.75
37	Over flooding of fish ponds by floods making feeding difficult	Yes No	16 16	50.00 50.00
38	Loss of fish as a result of flooding	y Yes No	22 10	68.75 31.25
39	Loss of available land and fish ponds due to coastal erosion	Yes No	10 22	31.25 68.75
40	Poor quality of fish due to contamination as a result of floods	Yes No	6 26	18.75 81.25

From the data presented above, one will see that all the farmers (crop, animal, fish etc) are affected by the rising temperatures as a result of climate change. weather and climate change affected their production capacity e.g. one season cropping, decline in soil fertility, decline in productivity, decline in quality of

products, increase in pests and diseases attack on products etc. resulting in poor quality of stored products, high cost of production etc.

The above findings are in line with above (2018) who reported that desert encroachment, poor precipitation, droughts, loss of soil fertility, poor vegetation, poor agricultural yield, food insecurity among others were some of the effects of climate change in Nigeria. Ajanaku (2014) on his part lamented that “the reality however is that climate change or global warming has become a very problematic reality, with effects that have piled more woes on top of the existing governance challenges the ordinary Nigerian faces. The reality of climate change means that seasonal cycles are disrupted, so too are ecosystems, the natural habitat within which all economic activities must take place.

Table 3: Mean Responses of Climate Change Mitigation Strategies for all Farmers

S/N	MITIGATION STRATEGIES	FREQUENCIES	MEAN	REMARKS
41.	Climate index-based insurance policy to help farmers mitigate climate related risks	400	4.10	Very useful
42.	Increased investment throughout the value chain	400	4.40	Very useful
43.	Use of ICT in agriculture (to receive information on climate, weather, markets etc)	400	4.20	Very useful
44.	providing affordable inputs to farmers	400	3.89	Very useful
45.	Reform of fertilizer and seed policies	400	3.90	Very useful
46.	Expanding access to financial services	400	4.15	Very useful
47.	Social safety nets to reduce vulnerabilities especially for women and children	400	4.22	Very useful
48.	Improved road networks and marketing facilities	400	4.30	Very useful
49.	Assisted Natural Regeneration (ANR) to restore degraded lands through tree planting/Afforestation projects	400	4.42	Very useful
50.	Carbon footprints reduction through sequestration of large quantities of carbon in soil, tree	400	3.75	Very useful

From the data presented above it will be seen that the farmers took all the strategies above as being very useful in mitigating the effects of climate change. There is need for us as a nation to key into the recent UN planned Food systems Summit. According to Ndubisi (2021), it is time to change how we produce and consume, including to reduce green house emissions. Every citizen must change the way food is produced, processed transported, marketed and consumed. It is very important to state that the UN – REDD \$4M grant Nigeria received following her full admission as a Reducing Emissions from Deforestation and Forest Degradation (REDD) ready country should be put to good use and given to only the farmers that needed it. This is in line with Onyedika (2012) who observed that the grant will be used for building capacity, carbon mapping and other activities that will encourage Nigerians to cater for its endangered forests.

Table 4: Mean Responses of the Adaptation Strategies

S/N	Adaptation Strategies	Freq	Mean	Remarks
51.	1. CROP FARMERS Integrated pest management (IPM), use of eco-friendly practices and improved pesticides	220	3.76	Highly possible
52.	Optimizing irrigation schemes eg. SRI a technique of growing more rice with less water	220	4.01	Highly possible
53.	Managing soil nutrients and fertility through agro forestry	220	4.20	Highly possible
54.	Use of contour bunds to prevent erosion and promote water retention	220	4.30	Highly possible
55.	Switching to varieties tolerant to heat, drought or salinity	220	3.68	Highly possible
56.	2. ANIMAL/ LIVESTOCK FARMERS Remodeling animal pens/houses e.g. tunnel house ventilation which assists in heat stress management	44	3.90	Highly possible
57.	Animal tethering – cut and carry fodder to animal to avoid roaming	44	4.20	Highly possible
58.	Night feeding of livestock to be encouraged because of less heat.	44	4.18	Highly possible
59.	Switching to local breeds that are drought/ heat resistant	44	4.30	Highly possible
60.	Matching animal numbers to change in pastures	44	3.80	Highly possible
61.	3. FISH FARMERS Switching to more heat resistant/abundant breeds of fish.	32	3.75	Highly possible
62.	Restoring degraded habitats and breeding sites such as Mangrove forests	32	4.28	Highly possible
63.	Strengthening infrastructures such as ports and landing sites	32	3.60	Highly possible
64.	Integrated fish production system e.g. raising fish in rice farms/paddies	32	4.30	Highly possible
65.	Construction of dykes to keep ocean water from entering the plots and fish ponds	32	4.28	Highly possible

The table above showed that all the items recorded means ranging from 3.60 to 4.30. the items were all accepted as highly possible adaptation strategies. Nigerian farmers should be empowered and encouraged to adopt these strategies and more. For instance they should be made to borrow a leaf from their Ghanaian counterparts.

According to Chilumbu (2019) Ghanaian Smallholders have been introduced to a Pigeonpea-yam cropping system to help overcome the challenge of finding fertile soil to produce high yields. The pigeonpeas conserve moisture and fix atmospheric nitrogen, increasing sustainability, efficiency and yields. The leaves which are cut and spread before land preparation, also add to soil carbon and nutrient levels for sustaining soil fertility.

Table 5: Means Responses of the way forward

S/N	THE WAY FORWARD	FREQUENCIES	MEAN	REMARKS
66.	Adoption of climate- smart Agriculture (CSA) and other Agroecology concepts.	400	4.25	Very Important
67.	Ban on importation of exotic varieties and breeds that are not drought/ heat-resistant to upgrade our local breeds	400	4.10	Very Important
68.	Prioritization of genetics to develop breeds that are more resilient to climate change	400	4.30	Very Important
69.	Contract farming practices to strengthen growers association / commodity board and control price fluctuations	400	4.32	Very Important
70.	Improved networking between stakeholders, irrigation schemes and earth dams eg. Simple irrigation schemes should be funded by government and stakeholders	400	4.18	Very Important
71.	Youth empowerment and participation in agriculture	400	4.20	Very Important
72.	Water harvesting techniques employed to checkmate extreme floods	400	4.25	Very Important
73.	Effective media communication raising awareness of climate change issues and sharing timely updates during emergencies especially for remote communities	400	4.35	Very Important
74.	Mainstreaming gender in climate change discussion payments for environment services (PES) to be adopted	400	3.90	Very important
75.	Relocation or redistribution of agricultural production away from the flood prone coastal zones to forest and savannah zones	400	3.85	Very important

76	Use of renewable energy technologies and innovations in food processing and storage e.g use of solar powered refrigerating units	400	4.25	Very important
77	Capacity building in post-harvest technologies to reduce waste and value chain development	400	4.30	Very important
78	Subsidizing inputs for pastoralists and livestock farmers and setting up veterinary services centres in the LGSA	400	4.10	Very important
79	Mounting of UNDP/GEF food security and resilient project in the state	400	3.95	Very important
80	Supporting agricultural advisory services (AAS) for smart farming by digitwalizing extension	400	4.20	Very important

The table above showed that all the items recorded means ranging from 3.85 to 4.32. the items were all accepted as being very important in the way forward (ways of building resilience in agriculture).

The findings were in consonance with thorp (2015) who state that the way forward in the threat of climate change is in adopting Climate smart Agriculture (CSA) which she defined as “Agriculture that sustainably increases productivity resilience (adaptation), reduces/removes GHGs (mitigation) and enhances achievement of national food security and development goals.

The recent grants of \$1.5m by Bill and Melinda Gates Foundation for smart farming innovations in Nigeria is a welcome development. According to Essiet (2021), the grants are for smart farming solution that can demonstrate potential in meeting the following criteria within 12months: leveraging digital technology innovations with the potential to scale, show potential to improve incomes, productivity and ability to adapt to climate change. The fund should be made available to farmers.

In a related development, it is very comforting to note that in Nigeria, only Delta and Ogun State governments are members of the global agencies like R20, an agency founded by Arnold Schwarzenegger with its objective being able to help sub-national government around the world to develop and communicate low-carbon and climate-resilient economic development project (Ikem, 2017), Delta State farmers should be aided to get this fund. Again more farmers should be encouraged to sign up with SMART Agenda of Okowa administration. According to Uwagwu (2016), the SMART Agenda revolves around agriculture in order to proactive-reform the sector. Youths and young farmers should be empowered through its flagship programmes- YAGEP and STEP the acronyms which stand for Youth Agricultural Entrepreneurs Program (YAGEP) and Skills Training and Entrepreneurship Programme (STEP).

Conclusion

Farmers need to adapt to climate change while maintaining or increasing food production. At the same time, they need to adopt practices which reduce agriculture's climate footprint. From all indicates climate-smart agriculture is the way to go. Climate smart agriculture must achieve the triple goal of increasing food production, helping farmers to become more resilient to climate change and reducing emissions. Building climate change resilience in agriculture is critical not only to protect small holder farmers, who account for large percentage of food producers in the country, but also to ensure food and nutritional security for entire country. Business as usual is no longer an option for agriculture. Greater resilience must be built by combining sound ecological principles with improved production techniques

Recommendation

Based on the findings made and the conclusion drawn, the following recommendations were made:

1. The Federal Government through the Ministry of Agriculture and Rural Development should intensify the training of more extension agents for the states.

The current state of extension agents to farmers of one extension worker to 10,000 farmers is unacceptable.

2. Special programmes and funds to empower women in agriculture and women agribusiness enterprises to ensure family food security
3. Nigeria should sensitize her citizenry on climate change effects through mitigating these by letting people appreciate the reality and the need to practice mitigation and adaptation. Adaptation reduces the impact of climate stresses on human and natural systems, while mitigation lowers potential greenhouse gas emissions.
4. There should be total overhaul of food systems in the country. The citizenry should be sensitized to radically change the way food is produced, processed, transported, marketed and consumed in the country.
5. There is need for grassroots education on climate change effects and how to build resilience
6. Concerted efforts to be made by the stakeholders to move the country away from one circle of food production by adopting the relevant innovations and technologies.

Reference

- Above, M. (2018). UNIC, Others Advocate grassroots Education on Climate Change. THE GUARDIAN, Thursday, August 2. Vol. 35, No. 14, 463; 7
- Ajanaku, A. (2014). CLIMATE CHANGE: Boggled By Nigeria's Governance Challenge. THE GUARDIAN, Sunday September 28, 18
- Chilumbu, D. (2019). Reaping the Economic Rewards of Conservation Spore. Cta. Int. NOT 193, June-August, 12-13
- Essiet, D (2021). Smart farming Gets \$1.5m Agric. Grants. THE NATION, Thursday, February 4, Vol 13, No. 5302, 25
- Hailu, M. (2011) Spore Educatorial, No 155, October-November, 3
- Hailu, M. (2013). Building Resilience in Agriculture. Spore No 163, April-May, 3
- Kafeero, F. (2021). Insecurity and Looming food Crisis. THE GUARDIAN, Sunday, March 14. Vol. 37, No. 15, 147, 12.
- Ndubisim, F. (2021). Amid Global Crisis, UN plans Food System Summit. THURSDAY, Sunday, January 3. Vol. 25, No.9401, 8.
- Olaopa, T. (2021). The Need for National Resilience Policy and Standard Thursday, Sunday, February 28. Vol. 26, No. 9457, 81.
- Onyedika, N. (2012). Nigeria gets UN-REDD \$4M Grant for carbon Mapping. The Environment on Guardian, Monday April 2, 48.
- Pye-Smith, C. (2011). Farming's Climate-smart future: Placing Agriculture at the Heart of Climate Change Policy. A publication of technical Centre for Agriculture and Rural Cooperative-CTA/CCAFS, 36 pp.
- Thorp, S. (2015). Climate Change Challenges and Opportunities Towards 2050: No Time to Waste. Spore Special issue, October, 3-7
- Uwagwu, M. (2016). Okowa: Between Man and Agriculture. SMART DIMENSION-The Pointer, Tuesday, October 11, 11