Available online www.unicrossjournals.com

JOURNAL OF CONTEMPORARY RESEARCH (JOCRES)

RESEARCH ARTICLE VOL. 3 (1) ISSN:2814-2241

Date Published: March 31, 2024

Pages 21 - 31

AGROFORESTRY AND ORGANIC FARMING AGRICULTURAL PRACTICE: TOWARDS CLIMATE CHANGE MITIGATION IN CROSS RIVER STATE, NIGERIA.

Agbor, Cassidy Etta[1], Udumo Bassey Obeten Ukam[1], Ogholo Ngwu[1], and Igwebuike, Osedumme[2]

[1]Department of Environmental Education, University of Calabar, Calabar Cross River State, Nigeria.

[2]Department of Curriculum and Teaching University of Calabar, Cross River State, Nigeria.

Abstract

The purpose of this study was to investigate ascertain the influence of agroforestry and organic farming practices on climate change mitigation in Cross River State, Nigeria. To achieve the purpose of this study, two null hypotheses were formulated to serve a guide for the study. The sample for the study consisted of four hundred and ninety-five (495) registered farmers with the Agricultural Development Programme in Cross River State. A detailed review of related literature was carried out in line with the variables of the study. Stratified random sampling technique was adopted in selecting the local government areas while systematic random sampling technique was adopted to select the four hundred and ninety-five respondents used for the study. A thirty-five item four-point Likert scale questionnaire was the instrument used for collection of data. The research instrument was subjected to validity test by relevant authorities. Cronbach alpha method was utilized to establish the reliability of the research instrument. The testing of hypotheses in the study was done with simple linear regression statistical tools. The hypotheses were tested at 0.05 level of significance. The result that was obtained from data analysis and hypotheses testing in the study revealed that there was a significant influence of agroforestry and organic farming on climate change mitigation. Based on the findings obtained in this study, it recommended that the Ministry of Agriculture in collaboration with the Forestry Commission should continue to collaborate in order to promote the use agroforestry by farmers in the study area as a means of mitigation climate change and Farmers in the study area should be adequately sensitized by extension officers on the need to continue to practice organic farming within the study area so as to continually contribute to climate change mitigation efforts.

Keywords: Agroforestry, Organic farming, climate change, mitigation, agricultural practices, Cross River State.

1.0 Introduction

Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or

changing management practices or consumer behavior. It can be as complex as a plan for a new city or as simple as improvements to a cooking stove design. Efforts underway around the world range from high-tech subway systems to bicycling paths and walkways. The Paris Agreement of 2016 brought all nations into a common cause to prevent the rise of global temperatures this century above 2°C relative to preindustrial levels, and to make further efforts to limit the temperature increase to 1.5°C. Taylor (2018) asserts that Many United States cities have evaluated the impacts of climate change on their communities and developed action plans to reduce greenhouse gas emissions. For instance, Washington DC published a sustainable plan in 2013, aiming to reduce 50% and 80% of greenhouse gas emissions in the district by the year 2032 and 2050, respectively, relative to the emission level of 2006. This plan was adjusted in 2018 to net-zero carbon emission by 2050. Los Angeles released an action plan in 2007, intending to reduce greenhouse gas emissions to 35% below 1990 levels by the year 2030.

Climate change mitigation intends to reduce greenhouse gas emissions and concentrations in the atmosphere. The strategies employed by major cities around the world include retrofitting existing commercial and multifamily buildings to improve their energy efficiency and reduce their reliance on fossil fuels for heating and cooling. Others include implementing net-zero energy building code for new construction, improving energy efficiency and reducing overall consumption, increasing electricity generation and optimizing energy distribution system; increasing the share of renewable energy in energy supply; developing renewable portfolio standards to steadily increase the use of renewable energy; reducing dependence on private vehicles and increasing the use of public transit, increasing biking and walking; and deploying zero-emission electric vehicles. Climate change mitigation means to take appropriate action to prevent and minimize damages and to take advantage of opportunities created by such change.

The recognition of agriculture as both a cause and consequence of climate change has necessitated the adoption of several agricultural practices that are intended to contribute to climate change mitigation measures. One of such agricultural practices is agroforestry. Mikan (2018) asserts that agroforestry has been identified as an environment-friendly farming practice, which encourages the cultivation of crops along with planting of trees. The practice of agroforestry has contributed significantly to the restoration of lost forests as well as reclaiming of degraded ecosystems. The planting of trees through agroforestry has potentials to provide vegetation cover, which serves as carbon sinks. These sinks help to sequestrate carbon emissions into the atmosphere and prevent further changes in climatic conditions. This can positively contribute to climate change mitigation efforts that would continue to ensure a safe and healthy environment for both humans and other living organisms.

Wilson (2018) identifies organic farming as a farming practice that has potentials to contribute to climate change mitigation. The practice of organic farming involves the use of organic manure, where crop remnants from one species are used to boost the cultivation and nutrients required by specie with longer maturity period. Organic farming does not support the use of artificial fertilizer, pesticides, herbicides and other chemicals associated with other forms of farming practices. This reduces the amount of carbon

released into the environment. Soil viability is usually sustained through this farming practice, thereby reducing the rate of demand for virgin land to boost crop yield. The reduction in the rate of deforestation and improvement of soil capacity to absorb carbon gives credit to organic farming. The ability to regulate rising temperature and consequences of climate change underlines the contribution of organic farming to climate change mitigation.

Simon (2019) stated that Climate change has a strong correlation with agriculture; typically, in developing countries where their livelihood is directly associated with farming activities which particularly depends on rainfall. In tropical agriculture, particularly subsistence, agriculture is vulnerable as smallholder farmers do not have adequate resources to adapt to climate change. The use of improved agricultural practices that incorporates planting of trees is one of the alternating and promising strategies to combat climate change. In fact, agroforestry is currently viewed as a "bright sector" for combating climate change in different parts of the world. Additionally, agroforestry is considered as a cost-effective strategy. Agroforestry systems have the potential to provide significant mitigation options, but they require proper management that influences the amount of carbon sequestered. In Africa, while agroforestry may play a significant role in mitigating the atmospheric accumulation of greenhouse gases (GHG), it also has a role to play in helping smallholder farmers adapt to climate change. In Africa, of all agricultural land management activities suggested for GHG mitigation, agroforestry practices have been the most widely applied and studied too.

Mane (2019) equally stated that Agroforestry strengthens agricultural resilience by increasing crop yields and offering better environment for farm animals. It also modifies microclimate in ways that can improve crop yields from 6 to 56 % depending on crop type. Reducing soil erosion from water and wind, and improving soil physical condition and fertility, Climate variability is well buffered by agroforestry because of permanent tree cover and varied ecological niches. Creating habitat, protecting biodiversity, including pollinators and beneficial insects are the most important aspect of agroforestry system. In fact, Taylor (2018) also indicated that agroforestry has the potential to restore degraded lands, provide a broader range of ecosystem goods and services such as carbon (C) sequestration and high biodiversity, and increase soil fertility and ecosystem stability through additional carbon input from trees, erosion prevention, and microclimate improvement. Carbon sequestration through agroforestry system: Carbon emission is higher from deforestation and forest degradation. However, this can be managed through the sustainable management of land and forests. The enhancement of forest carbon stocks through agroforestry can be considered as one of the main options for reducing greenhouse gases in the atmosphere. For instance, the United States of America produces about 25% of global carbon dioxide emissions from burning fossil fuels. The greatest role of agroforestry in relation to climate change is perhaps in mitigating the emissions of carbon dioxide by sequestering carbon from the atmosphere.

Kusternmann (2016) reported that organic farming is a traditional farming system that

commonly uses cover crops, legumes, compost animal and green manures and animal by-products; fish, bones, and blood meats in their soil-building and nutrient management programmers. The author noted that in comparison with conservational farming system and traditional farming system, organic farming system was found to have better overall soil quality, as measured by soil properties such as more organic matter, better structure, less microbial actions and diversity, than the conventional counterparts. The practice of organic farming has been identified by Simon (2017) as system that does not encourage the use of pesticides or herbicides that contribute to greenhouse effect. The adoption of natural processes makes this farming practice environmentally friendly. The waste generated from one farming activity is used as food or manure for another activity. This also reduces the emission of methane into the atmosphere and cutting down the climatic effect associated with methane. Overall, organic farming can be considered as a climate change mitigation farming practice in the areas where it is effective implemented. This promotes environmental sustainability.

Frederick (2015) maintained that organic agriculture does not permit the use of synthetic chemical, pesticides, herbicides and fertilizers. An organic management approach needs to go beyond substitution of chemical input by improved organic inputs and needs to include the principles and practices that promote sustainable environmental management. Babatunde (2016) declared that organic farming focuses on fertile soil that has high microbial activity. Building and maintaining healthy soil is regarded as a key factor in maintaining plant health and environment, which is thought to help reduce pest and disease problems by preventing crop stress or nutrient imbalance. Babatunde (2016) further suggested that managing biota within the system soil fauna are seen as critical to a healthy soil. Pest- predator balance within the soil and across the landscape is regarded as important to all systems. It is critical to many fruit and vegetable crop that encourage environment health. A shift from the use of pesticides, herbicides and artificial fertilizer as associated with organic farming reduces the level of carbon emission into the atmosphere. This helps to prevent the emission of greenhouse gases, which are directly linked with global warming, which is a consequence of climate change. Organic farming protects the environment through reduced emission and protection of soil nutrients. This helps to reduce the rate of deforestation in search of arable land for crop cultivation. The long-term benefit of this practice is the reduction of carbon emission, which will definitely mitigate against climate change effects

2.0 Statement of the problem

Humans are constantly involved in a variety of activities that degrade the quality and well-being of the environment. This continuous degradation of the environment has resulted in the destruction of plant species and emission of greenhouse gases into the atmosphere. The regular emission of greenhouse gases into the atmosphere has resulted in severe alteration of natural climatic conditions. These changes in climatic condition due to loss of plants in particular have brought about adverse consequences including increasing temperature, reduction of oxygen in the atmosphere, drought, flooding, deforestation, erosion among others. These consequences have brought about varying thoughts, fear and assumptions among people in various locations within the study area on the negative effects of climate change.

The irony of this situation is that, despite the glaring consequences of climate change facing people in the study area, many people still do not seem convinced on the need to carry out sustainable agricultural practices as a means of reducing the adverse effect of climate change. Residents of the study still indulge in farming practices that promote the emission of greenhouse gases into the atmosphere. Government and other stakeholders have made efforts in creating awareness and sensitizing people on adaptation strategies and on the need to consider alternative farming practices that constitute severe climatic problems. These efforts have yielded insignificant results as the incidence of climate change seem to be on the increase in the study area.

These efforts are geared towards raising a citizenry that is aware of and committed to finding lasting solutions to the increasing incidence of climate change. One of the approaches adopted to mitigate climate change in the study area is the introduction of sustainable agriculture. Agriculture has long been identified as a major contributor to increasing climate change. The need for farmers to adopt farming practices that would consistently contribute to climate change mitigation has become imperative as part of efforts made to change the narrative. This is because the mitigation of climate change will enhance food production, ecosystem sustainability, regulate temperature, and ensure continuity of society. This emphasizes the need to consciously promote climate change mitigation among farmers in the study area. This study is geared towards attempting to find answers to the question, how does agroforestry and organic farming practices influence climate change mitigation in Cross River State Nigeria?

3.0 Objectives of the study

Specifically, the general purpose of the study aims:

1. Examine the influence of agroforestry on climate change mitigation in Cross River State Nigeria
2. Ascertain the influence of organic farming on climate change mitigation in Cross River State Nigeria.

4.0 Research Questions

The following research questions will guide this study:

1. How does agroforestry influence climate change mitigation?
2. To what extent does organic farming influence climate change mitigation?

5.0 Statement of Hypotheses

1 There is no significant influence of agroforestry on climate change mitigation in Cross River State

2 Organic farming does not significantly influence climate change mitigation in Cross River State.

6.0 Methodology

A descriptive survey research design was adopted for the study. The stratified random sampling technique and proportionate sampling approach were used for this study. The local government areas in the state were stratified into three education zones, while proportionate sampling approach was

adopted to select the local government areas used for the study. Table 1 shows the sample distribution of the study. The data collected were analyzed with Simple linear regression analysis at .05 level of significance.

TABLE 1

Sample distribution for the study

S/N	LGAs	Sampled communities	Population	Sample
1.	Akpabuyo	4	886	44
2.	Akamkpa	5	1127	56
3.	Biase	4	947	47
4.	Odukpani	3	829	41
5.	Boki	7	1288	64
6.	Ikom	4	966	48
7	Yakurr	5	1087	54
8.	Ogoja	3	908	45
9.	Obudu	4	984	49
10.	Yala	4	948	47
	Total	43	9970	495

Source: Fieldwork, 2022

7.0 Results

7.1 Hypotheses One: There is no significant influence of agroforestry on climate change mitigation. Agroforestry is the independent variable in this hypothesis while climate change mitigation is the dependent variable. The statistical tool for data analysis was simple linear regression analysis. The result as presented in Table 2.

TABLE 2

Simple linear regression analysis of the influence of agroforestry on climate change mitigation in Cross River State (N = 493)

Model	R	R^2	Adj.R^2	Std error of estimate	
1	.287*	.083	.081	.97648	
Model	**SS**	**Df**	**MS**	**F**	**Sig**
Regression	42.100	1	42.100	44.152	.000
Residual	468.180	491	.954		
Total	510.280	492			

a. Dependent Variable: Climate change mitigation
b. Predictors: (Constant), Agroforestry

The result of data analysis of hypothesis one presented in Table 2 reveals that the independent or predictor variable

(agroforestry) has a significant influence on the dependent or predicted variable (climate change mitigation) among residents of Cross River State. This implied that agroforestry accounted for 8.3% of climate change mitigation in the study area.

Again, the result of regression ANOVA presented in Table 2 revealed that there was a significant influence of agroforestry on climate change mitigation, F (1, 491) = 44.152; p<.05. The result of this analysis showed that there is a low contribution of agroforestry practice to climate change mitigation. This indicated that agroforestry is positively influencing climate change mitigation in the study area.

7.2 Hypothesis two: Organic farming does not significantly influence climate change mitigation. Organic farming is the independent variable in this hypothesis while climate change mitigation is the dependent variable. The statistical tool employed for data analysis was simple linear regression analysis. The result is presented in Table 3.

TABLE 3

Simple linear regression analysis of the influence of organic farming on climate change mitigation in Cross River State (N = 493)

Model	R	R^2	Adj.R^2	Std error of estimate	
1	.300*	.090	.088	.97253	
Model	SS	Df	MS	F	Sig
Regression	45.886	1	45.886	48.515	.000
Residual	464.394	491	.946		
Total	510.280	492			

a. Dependent Variable: Climate change mitigation

b. Predictors: (Constant), Organic farming

The result of data analysis of hypothesis two presented in Table 3 reveals that the independent or predictor variable (organic farming) has a significant influence on the dependent or predicted variable (climate change mitigation) among residents of Cross River State. This implied that organic farming accounted for 9.0% of climate change mitigation in the study area.

Again, the result of regression ANOVA presented in Table 3 revealed that there was a significant influence of organic farming on climate change mitigation, F (1, 491) = 48.515; p<.05. The result of this analysis showed that there is a low contribution of organic farming practice to climate change mitigation. This indicated that organic farming is positively influencing climate change mitigation in the study area.

8.0 Discussion of findings

8.1 Agroforestry and climate change mitigation

The finding that was gotten from data analysis and testing of hypothesis one in this study showed that the null hypothesis was rejected. The indication of this finding is that there was a significant influence of agroforestry on climate change mitigation in Cross River State, Nigeria. The finding could be traced to the fact that one of the viable approaches to mitigating climate change has been tree planting. As a result, agroforestry provides a platform for tree planting while growing crops on the same portion of land. Over the years, this practice has contributed to forest regeneration and afforestation across various communities, who have experienced high level of deforestation. The planting of trees through agroforestry practice has encouraged carbon sequestration and regulation of temperature. These services provided by trees have been considered as contributing positively to efforts aimed at mitigating climate change.

The finding of this study is in line with that of Simon (2019) who reported that Climate change has a strong correlation with agriculture; typically, in developing countries where their livelihood is directly associated with farming activities which particularly depends on rainfall. In tropical agriculture, particularly subsistence, agriculture is vulnerable as smallholder farmers do not have adequate resources to adapt to climate change. The use of improved agricultural practices that incorporates planting of trees is one of the alternating and promising strategies to combat climate change. In fact, agroforestry is currently viewed as a "bright sector" for combating climate change in different parts of the world. Additionally, agroforestry is considered as a cost-effective strategy. Agroforestry systems have the potential to provide significant mitigation options, but they require proper management that influences the amount of carbon sequestered. In Africa, while agroforestry may play a significant role in mitigating the atmospheric accumulation of greenhouse gases (GHG), it also has a role to play in helping smallholder farmers adapt to climate change. In Africa, of all agricultural land management activities suggested for GHG mitigation, agroforestry practices have been the most widely applied and studied too.

The finding of this study also supported that of Mane (2019) who stated that Agroforestry strengthens agricultural resilience by increasing crop yields and offering better environment for farm animals. It also modifies microclimate in ways that can improve crop yields from 6 to 56 % depending on crop type. Reducing soil erosion from water and wind, and improving soil physical condition and fertility, Climate variability is well buffered by agroforestry because of permanent tree cover and varied ecological niches. Creating habitat, protecting biodiversity, including pollinators and beneficial insects are the most important aspect of agroforestry system. In fact, Taylor (2018) also indicated that agroforestry has the potential to restore degraded lands, provide a broader range of ecosystem goods and services such as carbon (C) sequestration and high biodiversity, and increase soil

fertility and ecosystem stability through additional carbon input from trees, erosion prevention, and microclimate improvement. Carbon sequestration through agroforestry system: Carbon emission is higher from deforestation and forest degradation. However, this can be managed through the sustainable management of land and forests. The enhancement of forest carbon stocks through agroforestry can be considered as one of the main options for reducing greenhouse gases in the atmosphere. For instance, the United States of America produces about 25% of global carbon dioxide emissions from burning fossil fuels. The greatest role of agroforestry in relation to climate change is perhaps in mitigating the emissions of carbon dioxide by sequestering carbon from the atmosphere

8.2 Organic farming and climate change mitigation

The finding that was gotten from data analysis and testing of hypothesis two in this study showed that the null hypothesis was rejected. The indication of this finding is that there was a significant influence of organic farming on climate change mitigation in Cross River State, Nigeria. The finding could be traced to the fact that agriculture has been identified as a source of emissions that result in climate change. This accounts for the proposal for an improvement in agricultural practices that would emit less carbon into the atmosphere. Hence, organic farming has potentials to achieve increased food production without emission of carbon into the atmosphere. The use of organic manure and processes in farming reduces the threats posed by agriculture to climate change. Hence, organic farming constitutes a mitigation measure that reduces the effects of climate change. This accounts for the positive relationship between organic farming and climate change mitigation in the study area.

The findings of this study is in agreement with that of Kusternmann (2016) reported that organic farming is a traditional farming system that commonly uses cover crops, legumes, compost animal and green manures and animal by-products; fish, bones, and blood meats in their soil-building and nutrient management programs. The author noted that in comparison with conservational farming system and traditional farming system, organic farming system was found to have better overall soil quality, as measured by soil properties such as more organic matter, better structure, less microbial actions and diversity, than the conventional counterparts. The practice of organic farming has been identified by Simon (2017) as system that does not encourage the use of pesticides or herbicides that contribute to greenhouse effect. The adoption of natural processes makes this farming practice environmentally friendly. The waste generated from one farming activity is used as food or manure for another activity. This also reduces the emission of methane into the atmosphere and cutting down the climatic

effect associated with methane. Overall, organic farming can be considered as a climate change mitigation farming practice in the areas where it is effective implemented. This promotes environmental sustainability.

The finding of this study is also supportive of the finding of Frederick (2015) who maintained that organic agriculture does not permit the use of synthetic chemical, pesticides, herbicides and fertilizers. An organic management approach needs to go beyond substitution of chemical input by improved organic inputs and needs to include the principles and practices that promote sustainable environmental management. Babatunde (2016) declared that organic farming focuses on fertile soil that has high microbial activity. Building and maintaining healthy soil is regarded as a key factor in maintaining plant health and environment, which is thought to help reduce pest and disease problems by preventing crop stress or nutrient imbalance. Babatunde (2016) further suggested that managing biota within the system soil fauna are seen as critical to a healthy soil. Pest- predator balance within the soil and across the landscape is regarded as important to all systems. It is critical to many fruit and vegetable crop that encourage environment health. A shift from the use of pesticides, herbicides and artificial fertilizer as associated with organic farming reduces the level of carbon emission into the atmosphere. This helps to prevent the emission of greenhouse gases, which are directly linked with global warming, which is a consequence of climate change. Organic farming protects the environment through reduced emission and protection of soil nutrients. This helps to reduce the rate of deforestation in search of arable land for crop cultivation. The long-term benefit of this practice is the reduction of carbon emission, which will definitely mitigate against climate change effects.

9.0 Conclusion

From the analysis of data and testing of hypotheses in the study it was found that there was a significant influence of agroforestry, and organic farming, on climate change mitigation in the research area. In conclusion, agroforestry and organic farming covered in this study positively influence climate change mitigation in Cross River State, Nigeria**.**

10.0 Recommendations

On the basis of the findings of this study, the following recommendations were made:

1. The Ministry of Agriculture in collaboration with the Forestry Commission should continue to collaborate in order to promote the use agroforestry by farmers in the study area as a means of mitigation climate change
2. Farmers in the study area should be adequately sensitized by extension officers on the need to continue to practice organic farming within the study area so as to continually contribute to climate change mitigation efforts.

REFERENCES

Babatunde, D. U. (2016). Emerging issues on traditional agricultural practices and dwindling soil fertility: implication for food security. *International Journal of Environmental Management, 3(6), 112-119*

Frederick, W. E. (2015). *Farming approaches and environmental sustainability in rural Nigeria*. Lagos: Jordan Press

Kusternmann, V. N. (2016). Farming practices and land conservation in Nigeria: Issues and challenges. A seminar presented at an environmental summit in Lagos, Nigeria.

Mane, D. A. (2019). Changing climate conditions: The role of agroforestry in mitigation efforts. *Journal of Environmental Science, 4)1_, 411-418*

Simon, E. M. (2019). *Climate change mitigation: Implication for sustainable agriculture in Nigeria.* Enugu: Ugwuowo Press

Simon, U. L. (2017). *Elements of tropical ecology*. London: Heinemann Educational Books.

Taylor, D. O. (2018). Burning for biodiversity or burning the biodiversity*? International Journal of Agricultural Research, 4(7) 76-84*

Taylor, G. O. (2019). Competition and facilitation: a synthetic approach to interactions in plant communities. *Ecology, 78, 58–65*.

Vidal, R. L. (2017). Stability increases with diversity in plant communities: empirical evidence from the 2008 Yellowstone drought. *Oikos, 62, 360–362.*

William, T. N. (2018). *New techniques in farming for improved climatic conditions management South-East Nigeria*. Harbour Press Ltd

Williams, C. P. (2020). *Conservation strategies and management of forest resources for improved rural livelihood.* Ibadan: Cymart press

Wilson, J. O/ (2019). *How to improve food production in a relatively fixed carrying capacity of the earth*. Washington DC: FAO

Wilson, J. R. (2018). The eleventh hypothesis shade. *Agroforestry Today,* 2, *14-15*.