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Effect of Climate Change and Oil Pollution on Agriculture in Agricultural Zone 1, Rivers State, Nigeria

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ABSTRACT
This study investigated the impact of climate change and oil pollution on agriculture in Agricultural zone one, Rivers State. Three objectives guided the study. The study adopted the survey design. The population of the study consisted of 4,566 registered farmers comprised of farmers from Khana (331), Gokana (2,536), Tai (252), and Eleme (1,447) Local Government Areas of Rivers State that make-up Ogoni land. The sample size consisted of 368 respondents based on the derivation of the Taro Yemen Sampling formula while simple random sampling was used to select the respondents. A Climate Change and Oil Pollution on Agriculture Questionnaire was used for data collection. The instrument had a reliability index of 0.84, determined through the Cronbach Alpha Statistic. Mean and standard deviation were used to analyze data. Findings from this study revealed that agriculture in the study area is negatively affected by climate change and oil pollution. The study recommended amongst others that approaches to tackling the challenges in agriculture in the study area must seek to deploy new approaches to agricultural practices, adaptability of farming systems to changing environment and regulation of anthropogenic factors that trigger climate change and pollution of farmlands. To address the challenges posed by climate change and oil pollution on agriculture, more robust and comprehensive strategies that would address the root causes of vulnerabilities and emerging risks need to be addressed.

Keywords: Climate Change, Oil, Pollution, Agriculture, Food Security, Ogoni.

INTRODUCTION

Climate change is widely regarded as one of the most pressing issues confronting societies both locally and globally. It is a natural occurrence that causes drastic variations in weather and temperature patterns, as well as repercussions including changed precipitation, inundation, flooding, and erosion. According to Bello, Ganiyu and Wahad (2012), climate change is one of the most environmentally life-threatening threats to the economic development and sustainability of mankind worldwide. The reason why climate change is interpreted as a crisis is that it affects the very sources of human livelihood, which are agriculture and the environment. Any disturbance in either agriculture or the environment affects the sources of livelihood of communities and poses a threat to food security and human survival, particularly in developing countries like Nigeria.

Oil pollution is defined as the man-made or man-aided alterations of the chemical, physical, or biological quality of the environment to the extent that is detrimental to that environment or beyond acceptable limits in the course of the extraction, storage, or transportation of petroleum oil (Legbosi, 2007). The release of contaminants or pollutants associated with the extraction of crude oil into the environment can pose a danger to agricultural activities because they can interfere with normal plant processes and disturb the balance of ecological systems. It can also affect the quality of life and reproduction rates of aquatic organisms. As such, the effect of this human activity can be a threat to agricultural activities and sustainable food security.

Agriculture is a major form of human activity on the earth's surface, which involves cultivating the soil, producing crops and raising livestock, and, to varying degrees, the preparation and marketing of the resultant products. In developing countries like Nigeria, agriculture not only employs a very large percentage of the population but also provides a source of food, raw materials, and items of trade and commerce. Agriculture is thus the main basis of the livelihood of the vast majority of the population, as they engage in agriculture for their daily food supply, source of income, and employment. Food security is defined as the capacity of individuals, households, and communities to access sufficient food so that their dietary needs are met over some time (Antwi, 2013). The importance of ensuring food security stems from the fact that failure to access adequate food will cause malnutrition and poor health, leading to additional poverty, poor physical and mental development, decreased labour productivity in

agriculture, and eventually the demise of society. Therefore, food security should be the goal of policies and programmes that seek to improve the lives of all Nigerians by boosting food production and thereby improving household livelihoods.

Unfortunately, man does not have absolute control of agricultural activities, which is an indirect product of food security. Because food security depends on production, it is not possible to ensure food supply without controlling the forces of nature that determine the quantity and quality of agricultural produce. Agriculture and food security primarily depend on natural conditions; that is, they are largely controlled solely by physical conditions such as temperature, precipitation, and water supply; soil (edaphic factors); wind, altitude, angle of scope, and aspect (Waugh, 1995, cited in Ladan, 2014). Furthermore, the effect of oil pollution on agriculture stems from the fact that oil droplets have a high surface tension, making it easy for them to penetrate organic structures, and it is often very difficult to remove them without causing further damage to these environments (Chan and Baba, 2009). Therefore, this alteration and contamination have led to disruption in the seasonal pattern of food production and distribution, thereby creating a shortfall in supplies, which in turn raises food prices and limits access to food (Oyinloye, Akinola, Akande, Akinyele, and Mosimabale, 2018). This is the situation in Ogoni Land, where agriculture is highly dependent on climate elements such as temperature, precipitation, and water supply, as well as hindered due to the contamination from oil pollution; a situation that has led to not only disruption in the seasonal pattern of food production and distribution, but also making access to food scarce and expensive, while placing the health of children and adults at risk.

Consequently, the resource-poor farmers, therefore, faced the prospects of tragic crop failures which reduced agricultural productivity, increased hunger, poverty, malnutrition, and diseases (Zoellick and Robert, 2009; Obioha, 2009). Due to these environmental threats resulting in a decline in crop yields, some farmers in Ogoni land are abandoning farming for non-farming activities as a result (Apata, Ogunyinka, Sanusi, and Ogunwande, 2010). Hence, concerted efforts towards tackling these menaces are necessary. Hence, this study is aimed at finding out the impact of climate change and oil pollution on food security in Agricultural zone 1, Rivers State.

STATEMENT OF THE PROBLEM

Oil pollution for decades has led to the contamination of Agricultural zone 1, especially Ogoni land, a situation which led to the Ogoni Uprising in the 1990s. As a result, oil companies have for decades found it difficult to carry out oil production in Ogoni land (UNEP 2011). Furthermore, due to the influence of the tides and, at times, floods in conjunction with rain, spilt oil is rapidly distributed over large areas and remobilized with rising tides. Most of the contaminants originate from leaking pipelines, wellheads, and flow stations; from spills in connection with the transport of mostly stolen oil; from illegal tapping of the wells; and artisanal refining under very primitive conditions. As a result of the contamination of oil in mangroves and wetlands as well as on land, oil has penetrated soil down to several meters and has contaminated groundwater over large areas. This has resulted in the contamination of water wells causing damage to agricultural products, sea life, fish, and the food chain as well as beaches and the quality of people's lives (Moffat and Linden 1995; Ana, Sridhar and Bamgboye, 2009; Mmom and Arokoyu, 2010; UNEP 2011).

Some communities in the zone like Bodo City, Whenyozor, Sugii, K-dere communities, etc. prided themselves on the variety of crops and seafood they used to produce. They farmed the land and explored the waters around them for aquatic foods. The local economy was tied to the richness of the land and waters. Unfortunately, they are presently complaining of poor crop yields, animal production neglect, and hardship (Abah, Orisakwe, Okoroma and Emerhirhi, 2020). As a result, many have left their homes because of the harsh economic effects of oil pollution on them. The communities can no longer fish, farm, or hunt because oil production has polluted their rivers and made farmlands unproductive (Oyem, 2013). Thus, this time has not been a good time for farming communities in the zone in the four local government councils of Khana, Gokana, Tai, and Eleme, as farming and fishing activities have become a nightmare for thousands of them because of the effects of oil pollution and climate change.

Climate change, being a global issue, has also impacted negatively on the farming communities in Agricultural zone 1 due to the reduction in rainfall, erratic and intermittent climatic conditions due to temperature changes, soil erosion, and an increase in the concentration of chemicals and metals in the soil and water as a result of oil spills. Consequently, climate change has affected the socio-economic development of the region because, due to reduced agricultural activities and the loss of homes, there has been a rise in unemployment and migration. A situation, which is considered to be a threat to the food security of the Ogoni people and the entire people of Rivers State. Buttressing the foregoing, Ayinde, Muchie, and Olatunji (2011); Ogbo, Ebele and Ukpere, (2013), and George, Adelaja, and Weatherspoon (2020) posited that climate change is the key driver of conflict in parts of Nigeria, which has worsened the food security situation in the country and has reinforced poverty in some communities. It is against this background that this study is designed to examine the impact of climate change and oil pollution on agriculture and food security in Ogoni Rivers State.

OBJECTIVES OF THE STUDY

The study investigated the impact of climate change and oil pollution on agriculture and food security in

agricultural zone 1, Rivers State. The specific objectives of the study were to:

1. Ascertain the situation of agriculture and food security in the study area.
2. Examine the impact of climate change on agriculture and food security in the study area.
3. Ascertain the impact of oil pollution on agriculture and food security in the study area.

METHODOLOGY

Agricultural Zones in Rivers State

Rivers State Agric. Zones	LGAs	Headquarters
Zone 1	Eleme, Gokana, khana, Tai, Obio/Akpor, Port Harcourt, Oyigbo, Ogu/Bolo	Bori
Zone 2	Degema, Abua/Odual, Bonny, Andoni, Asari-Toru, Akuku-Toru, Opobo/Nkoro Okrika.	Andoni
Zone 3	Ikwerre, Emohua, Ahoada East, Ahoada West, Ogba/Egbema/Ndoni, Omuma, Etche	Omuma

Source: RSADP, 2021

The study was conducted in Rivers State Agricultural Zone One (1). The study adopted a survey research design. The design was adopted since the study, is concerned with the description of events as they are. Nwankwo (2013) stated that it involves the researcher gathering data from a sample of items considered representative of the entire group, which describes certain features of the sample.

A multistage sampling technique was used for the study. In stage one, four LGA's (Khana, Gokana, Tai and Eleme) in agricultural zone one were purposely selected because of evidence of oil pollution in the area. In the second stage, five communities were randomly selected from each of the LGA's making a total of twenty communities in the study area. For stage three, fifteen farmers were randomly selected from each of the twenty communities earlier selected giving a sample size of three hundred (300) farmers. A Climate Change and Oil Pollution on Agriculture and Food Security Questionnaire was used for the data collection for the study. The instrument was an 18-item questionnaire scale on a 4-point Likert scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1, with a 2.5 criterion mean. The instrument was tested for reliability through a test-retest method, with a reliability coefficient of r = 0.84, ascertained through the Cronbach Alpha Statistic.

The copies of the questionnaire were administered to and retrieved from the respondents at their residence with the aid of research assistants recruited and trained for the administration and data collection for the study.

The collected data was analyzed using mean and standard deviation.

RESULTS

Objective 1: Ascertain the situation of agriculture in the study area

Table 1: Table 1: Mean score and standard deviation of the situation of agriculture in the study area

S/N	Items	Responses (n = 300)		
		$\bar{x}$	SD	Decision
1	The plot of planted cassava farm which should ordinarily take up to two months to harvest now takes barely three days to harvest because of the low yield	3.41	0.61	Agreed
2	The soil fertility in the study area has been tampered with such that cropping and other forms of agriculture are essentially exploitive because soil nutrients have been removed.	3.08	0.80	Agreed
3	Some vegetables and crops like watermelon and cucumber as well as okra, tomato, vegetables, garden egg, cocoyam, yam, and water yam have stopped growing or become so scarce because they barely survive when planted in the study area.	3.60	0.81	Agreed
4	Some species of seafood like oysters, periwinkles and snails are now scarce in swamps across the study area.	3.73	0.48	Agreed
5	Some of the species of aquatic foods usually found in the study area are no longer in the area as they could not survive the pollution of their habitat.	3.65	0.59	Agreed
6	The air-borne diseases generated by oil pollution do not only affect human beings but also contribute to the scarcity of livestock.	3.37	0.79	Agreed
	Grand Mean	**3.47**		

Source: Field Survey

Criterion Mean = 2.5: $\bar{x}$ - 1.00 - 2.49 = Disagree, $\bar{x}$ - 2.5 - 4.00 = Agree

Table 1 shows the situation of agriculture in the study area. However, the result indicated that the majority of the respondents agreed with items 1 - 6, with their mean scores greater than the criterion mean (2.5), while just a few of the respondents disagreed with the items. The grand mean of 3.47 implies that agriculture in the study area is negatively affected by climate change and oil pollution. The result stems from the devastating effect of climate change and oil pollution on the agriculture in the study area. This result agrees with the finding of Tasie and Wilcox (2021), who asserts that climate change and oil pollution do not only affects agriculture, but every aspect of human existence.

Table 2 shows the effects of climate change on agriculture and food security in the study area. However, the result indicated that the majority of the respondents agreed with items 7-12, with their mean scores greater than the criterion mean (2.5), while just a few of the respondents disagreed with the items. The grand mean of 3.39 implies that climate change has negatively affected agriculture and food security in the study area. This finding agrees with Tasie and Kalio (2019) and Tasie, Wilcox and Ajie (2017). In the studies they found that climate change reduced crop farm output, farmers' productivity, farmers' income, etc.

Objective 2: Examine the effects of climate change on agriculture and food security in the study area.

Table 2: Mean score and standard deviation of the effect of climate change on agriculture in the study area

S/N	Items	Responses (n = 300)		
		$\bar{x}$	SD	Decision
1	Changes in salinity, increasing acidity and rising sea temperature have adversely affected aquatic lives across fishing communities in the study area.	3.51	0.56	Agreed
2	Due to the environmental threats resulting from climate change, there is a decline in crop yields, which has made some farmers in the study area to abandon farming for non-farming activities.	3.31	0.71	Agreed
3	Changes in atmospheric temperature and relative humidity have resulted in increased breeding of various plant and animal pests resulting in a decline in agricultural yield	3.41	0.88	Agreed
4	Climatic conditions such as droughts and extreme temperature are some of the consequences of climate change that has negatively affected agricultural and food security in the study area	3.51	0.65	Agreed
5	Climate change conditions have threatened the livelihood of farmers as well as poses food security challenges overtime, to people of the study area.	3.41	0.61	Agreed
6	Climate change conditions have led to disruption in the seasonal pattern of food production and distribution, thereby creating a shortfall in supplies which brings rising food prices and limited access to food and nutrition.	3.16	1.07	Agreed
	Grand Mean	**3.39**		

Source: Field Survey

Objective 3: Ascertain the effects of oil pollution on agriculture and food security in the study area

Table 3: Mean score and standard deviation of the effects of oil pollution on agriculture in the study area

S/N	Items	Responses (n = 300)		
		$\bar{x}$	SD	Decision
1	Oil pollution problems result in low and unpredictable crop yields in the study area, which invariably make farmers more vulnerable.	3.60	0.81	Agreed
2	Oil pollution affects the availability of quality soil water due to surface and underground water contamination.	3.73	0.48	Agreed
3	Due to oil pollution in the study area, poor farmers have faced the prospects of tragic crop failures which reduced agricultural productivity, increased hunger, poverty, malnutrition and diseases.	3.56	0.67	Agreed
4	Due to the prevailing widespread pollution, agricultural lands are severely impacted causing a reduction in the quantity of harvest and resulting in a threat to food security.	3.63	0.81	Agreed
5	Because of the direct contact of oil contaminants with plants, or indirect contact via the absorption of nutrients from contaminated soils in the study area, the quality of food is severely impacted	3.69	0.48	Agreed
6	Due to oil pollution, the quality of the major staple food like cassava planted in oil-polluted soils is drastically reduced.	3.55	0.61	Agreed
	Grand Mean	**3.63**		

Source: Field Survey

Table 3 shows the effect of oil pollution on agriculture and food security in the study area. However, the result indicated that the majority of the respondents agreed with items 13-18, with their mean scores greater than the criterion mean (2.5), while just a few of the respondents disagreed with the items. The grand mean of 3.63 implies that oil pollution has negatively affected agriculture and food security in the study area in Rivers State. This finding is in agreement with the Ojimba, Akintola, Anyanwu and Manilla (2014), who in the their study on an economic analysis of crude oil pollution effects on crop farms in Rivers State, Nigeria, asserts that crude oil pollution reduced crop output significantly and detrimental to crop farm output and production in Rivers State.

CONCLUSION

Climate change and oil pollution are now a reality and their effects are felt in the study area. These effects are largely negative and have serious repercussions for agricultural activities, the quality of their yield, and food security. It is due to this that climate change and oil pollution are the biggest environmental issue facing the farmers of agricultural zone one, Rivers State. Climate change and oil pollution have a far-reaching negative impact on agriculture and other economic activities, which has necessitated the unavailability and inaccessibility to food in the study area. Based on the findings in this study it could be observed that climate change and oil pollution have brought negative impacts on agriculture and food security in the study area and Rivers State at large. However, conscious efforts must be made towards mitigating the impacts faced by the farmers who are at the receiving end.

RECOMMENDATIONS

Considering the findings and conclusions of this study, the following recommendations were proffered:

1. Approaches to tackle the challenges in agriculture and food security situation in Ogoni must seek to deploy new approaches to agricultural practices, adaptability of agricultural practices to changing environment and regulation of anthropogenic factors that trigger climate change and pollution of farmlands.
2. To address the challenges posed by climate change on agriculture and food security more robust and comprehensive strategies that would address the root causes of vulnerabilities and emerging risks need to be addressed.
3. The proposed clean-up of the study area must be seen as an emergency to restore the fertility of farmlands across communities in the study area to encourage a more robust and beneficial agricultural production pattern to ensure food sufficiency and sustainability.

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