

EFFECT OF ENVIRONMENTAL DEGRADATION AND DESERTIFICATION ON FOOD SECURITY IN FCT ABUJA

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Abstract

The study examined the effect of environment degradation and desertification on food security in FCT, Abuja. The study adopted a survey design using questionnaire to elucidate responses from 99 respondents who are farmers employees of selected farms within the FCT. Regression analysis was employed to test the hypotheses formulated. The result revealed that both environmental degradation and desertification had negative and significant effects on food security. Based on that, the study recommended that government at all levels should prevent desert encroachment by mandating individuals to plant five (5) for every one (1) tree brought down for any reason. And also, the study recommends that government should develop policies that are capable of preventing abuse of land by citizens thereby reducing the risk of degradation.

Keywords: Environmental degradation, Desertification, Food security, Abuja Nigeria

Introduction

Nigeria has about 65% of its population in the rural areas, where agriculture and agro-based occupations dominate the people's livelihood. Conscious attempts at developing the rural areas and improve the livelihood of its inhabitants will have to be agriculture-oriented (Nwachukwu & Nnadozie, 2011). Reports have shown that agricultural production and productivity remain below thresholds in the country, leading to food and fiber insufficiency and nutrition-related negativities. This scenario is despite intensified efforts both on the part of government at all levels and the private sector, at strengthening the development process at the rural level. However, an emerging constraint which further darkens this scenario is the negative effects of climate change on agricultural production and by extension, affecting food security.

Food security is vulnerable to extreme weather events such as drought and floods. A variety of food crops produced in Nigeria are all dependent on rainfall, such that where rain is in abundance (such as middle belt) crops dependent on rain are planted and in drier part of the country, crops that do not require much rain are cultivated (Adebayo et al., 2011). Climate change can seriously affect agricultural production and therefore food security. It may take the form of environmental degradation and desertification which are capable of affecting food security (Nwachukwu & Nnadozie, 2011).

Food security in Nigeria has not kept pace with the nation's population growth, because the population is growing at about 3.2 per cent per annum while food security is at about 2.0 percent (NBS, 2017) despite efforts by successive governments in Nigeria through policies and programmes among which are National Fadama Development Programme, Root and Tuber Expansion Programme (RTEP), and National Programme for Food Security (NPFS). These policies and programmes were aimed at raising the productivity and the efficiency of agricultural sector. Farmers face challenges of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases (Mohammed, 2015). This unfortunate scenario has continued to threaten food security in the country and hence the need for this study which sought to examine

the effect of environmental degradation and desertification on food security in FCT Abuja.

The study was guided by the following research hypotheses:

H₀₁: Environmental degradation has no significant effect on food security in FCT, Abuja.

H₀₂: Desertification has no significant effect on food security in FCT, Abuja.

LITERATURE REVIEW

Concept of Environmental Degradation

Environmental degradation is understood as a decline in resource quality and quantity in the structure of an ecosystem. A theoretical definition of environmental degradation implies a link between resource quality and the impact of resource decline on people and in particular the poor's livelihood and standard of living (Atef & Adel, 2014).

Environmental degradation can be described as the gradual reduction in the capacity of the environment to satisfy some specific needs as a result of natural disasters or human mismanagement (Kuponiya, 2001). Engagement in primary production activities such as agriculture, forestry, fishing and mining are dependent on environmental exploitation and these are antecedents to environmental degradation. Environmental degradation manifests in the forms of land degradation. Land degradation can be considered in terms of loss of actual or potential productivity or utility as a result of natural or anthropic factors. In context of productivity, land degradation results from a mismatch between land quality and land use and could indicate temporary or permanent long-term decline in ecosystem function and productive capacity. It may refer to the destruction or deterioration in health of terrestrial ecosystem, thus effecting the associated biodiversity, natural ecological processes and ecosystem resilience (Beinorth, Eswaran, Reich, & Van-Dell, 1991).

Land degradation occurs in the form of depletion or total loss vegetative cover, and loss of its biophysical and economic productivity through exposure of the soil surface to wind erosion and water erosion, and through salinization and water logging, leading to deterioration of the physical, chemical and biological properties of soil. The continued loss of vegetation through salinization and human activities also depletes the world's biodiversity, and it reduces the ability of natural environment for carbon sequestration, with the consequent long-term effects of global warming and climate; overgrazing in the case of rangelands is particularly serious in arid regions. Such conditions surrounded with very complex arising problems hitting severely the human well-being allow us to state plainly that we are in need of efficient programmes to be implemented in order to face the enormous challenges we are now facing to achieve our goal towards a sustainable use of the natural resources land and water (Kuponiya, 2001). Some causes of environmental degradation include:

Poverty, poverty may be created by negative and unjust social conditions such as structural inequality, ill health, poor nutrition, low morale and motivation, ignorance, non-availability of basic needs, which make life a bit more livable (NEST, 1991). Poverty pollutes the environment, creating environmental stress in different ways. Those who are poor and hungry will often destroy their immediate environment in order to survive. They will cut down forests, their livestock will overgraze grassland, they will over use marginal land and in growing number, they will overcrowd in to congested cities (The World Commission for Environment and Development WCED, 1987). The forces of poverty rather than perversity compel the poor to deplete natural resources.

Batie (1992) reported that since poor households must ensure their survival, they frequently have no choice other than to exploit and degrade their environment especially their land resources.

Population Growth, rapid and uncontrolled population growth stimulates higher and urgent need for increasing agricultural land. This in turn brings about shortening of fallow periods and migration into marginal land and forest reserves.

Concept of Desertification (Desert Encroachment)

The word desert was derived from the Latin word *desertus* meaning abandoned (Lalley, 2013). Scholars have viewed this concept from diverse perspectives social, economic, cultural, among others and the concept has often been thought of as desert encroachment. Desertification could be seen as a process whereby the productivity of arid or semi- arid land falls by 10% or more. It is explained that mild desertification is about 10-25% drop in productivity, serious desertification is 25-50% drop and very serious desertification is a drop of 50% or more which may lead to serious gullies and sand dunes (Emordi, 2013).

Dregne (1986) explained that desertification is a land degradation process that involves a continuum of change from slight to very severe degradation of the plant and soil resources and is due to man's activities. He clarified the concept as the improvement of terrestrial ecosystems under the impact of man, the process of deterioration in these ecosystems that can be measured by reduced productivity of desirable plants, undesirable alteration in the biomass and the diversity of the micro and macro fauna and flora, accelerated soil deterioration and increased hazards for human occupancy. Barrow (1999) stated that desertification is a process whereby the ecosystem losses its capacity to maintain and repair itself.

Desertification is the decline in the biological or economic productivity of the soil in the arid mid semi-arid areas as a result of various factors including human activities and variations in climate. Desertification often results in a decrease in the amount of vegetation covering the land. Soil temperature rise will accelerate the breakdown of organic matter in the soil and the evaporation of water. The absence of vegetation also enhances runoff and erosion by water and wind. Erosion may cause gullies lowering the water table and making, less water available for plants. The act effect is that people will be unable to grow enough food or raise livestock and more: resources will diminish creating environmental refugees as people make efforts to escape scorching environment. Other human needs such as fire wood, household and industrial energy, fruits for consumption and herbs for medicinal uses, will become scarce as desertification prevails. (Ijioma & Obasi, 2012)

Government Effort in Curbing Desertification in Nigeria

Nigeria is losing 2,168 sq.km of land range and crop land to desertification especially in the northern Nigeria (Olasupo, 2014) and need s combined efforts of states and other stakeholders to contain further encroachment. Efforts to curb desertification have been on for a long time because of the devastating effect on the environment and society at large. During the colonial era, an Anglo-French Commission in 1937 investigated desertification reports in the Northern part of Nigeria and directed the emirate to embark on tree planting exercise to stop the encroachment (Medugu, 2009). After independence, government and other stakeholders like the World Bank, the United Nations—and others have directed effort s in human and material resources to combat the situation and in turn ameliorate the living conditions of the people in these areas. The Nigerian government in preparing strategies to combat desertification and ensure sustainable development in the National Action Plan (NAP) identified several sectoral policies as

important in this regard. These include, National Policy on Environment, National Agricultural Policy, National Forestry Policy, National Conservation Policy (National Action Plan to Combat Desertification and Mitigate the effect of Drought in Nigeria. 2005) among others. These policies are effective for the implementation of NAP plans. They are to help in public awareness, environmental education of the populace, poverty alleviation, forest conservation, protection of land for agricultural activities, and provision of alternative sources of energy.

The National Agricultural Policy Plans in combating drought and desertification through; Protection of agricultural lands against drought, desertification, soil erosion and flood, Protection and Conservation of Forests, Promotion of alternative sources of energy, Integrated Water Resources Management and Promotion of appropriate farming system.

Concept of Food Security in Nigeria

Adetunji, Olaniyi, Aremu and Kolawade, (2005), stressed that agricultural production is still dependent on weather and climate despite the impressive advances recorded in agricultural technology which makes food available to all. A household is food secured when it has access to the food needed for a healthy life for all its members. Iheanacho and Abdullahi (2006) noted that food is a basic substance needed for sustenance of life which has to be provided to maintain good health and optimal performance. In view of these, it must be in adequate quality and quantity. Thus, food security is not only the availability but accessibility, procurement and intake of adequate quality and quantity of food by individual, household, community or region. According to FAO (2003), food security exists when people in a geographical location can meet their dietary needs within sufficient, safe and nutritious food at all times. The definition stands on two planks: the ready availability of nutritionally adequate and safe foods and the availability of dignified means of acquiring these foods. Unfortunately, these two planks are not implemented owing to high unemployment, the incidence of global warming and lack of dignified means of acquiring safe and nutritious food.

Although it is believed that worldwide, there is enough food to feed everybody adequately, nonetheless, food insecurity exists at the global, national, community, household and individual levels. At a global level, food security deals with food availability. Food security at the national level is dependent on the balance between food imports and local food production. Food security at the national level is not a good indicator of food security (Uwaegbute, 2011). To achieve this food security experts, need to work alongside agriculturists and biologists to maximize food production while minimizing further ecosystem and biodiversity loss (Ozor & Nnadi, 2011).

Indicators of Food Security

The multiple dimensions and interlinked variables associated with food security make it difficult to evolve a single indicator to represent food security. Braun et al., (1992) has suggested the following indicators to capture the various dimensions at the country, household and individual levels: food security at the country level can be monitored, to some extent, in terms of demand and supply indicators; food security at the household level is best measured by direct surveys of dietary intake however, it is important to note that current situation does not take care of the risk aspects, and also the changes in socio-economic and demographic variables such as wage rates, employment and price ratios; anthropometric information can be useful to represent individual level measures.

Empirical Review

Environmental Degradation and Food Security

Shahid, (2013) examined environmental degradation, a challenge to food security in Bangladesh, India. The area of study is called a land of water as many as 310 rivers crisscross all over the country. He observed that the irrigation water used from this river and direct disposal of industrial chemicals and other waste polluted the land and reduces productivity and seems to ominous link to food insecurity. The study focused on exploring the land and water pollution and its relationship with food security. Focused group discussion (FGD), individual interview, observations and secondary information were adopted for this study. The study observed that climate change will affect just everything such as due to global warming glacier will melted fast and more. Raise of sea level will inundated more fertile land; salinity in the river water will increase further. Change in the river course is not impossible, which is some time very natural one. The study recommends that at local level to control pollution and conservation of agriculture lands, demands stick implementation of exiting law, if not cover new law and policy should be adjusted to meet requirement of the food security.

Stein and Bekele, (2014) carried out a study on land degradation, drought and food security in a less-favoured area in Ethiopian highlands. It was observed that Land degradation, population growth, stagnant technology, and drought threaten food security in the area. The bio-economic model was used to analyse the combined effects of land degradation, population growth, market imperfections and increased risk of drought on household production, welfare and food security. The study found that the indirect effects of drought on household welfare through the impact on crop and livestock prices are larger than the direct production effects of drought. Provision and adoption of credit for fertilizer, although risky in itself, may lead to increased grain production and improved household welfare and food security. Provision of credit may have a negative effect on conservation incentives but this effect may be mitigated by linking a conservation requirement to the provision of credit for fertilizer.

Atef and Adel, (2014) carried out a study on land degradation, agriculture productivity and food security in Italy. The study sought to find out the extent to which land degradation affect agricultural productivity and poses a threat to productivity growth and food security is fundamentally influenced by economic, environmental and institutional factors; and also, the important role of the farmer responses to land degradation and its potential impacts on agriculture productivity and food security. The study found that technology development, acquisition and adaptation are central for combating land degradation. Various technologies can be employed to benefit and to have a positive influence on the lives of the people. New technologies innovations in fields such as land use and soil water conservations are needed most. Premise on the findings, this study further recommends that in the Mediterranean where land degradation is widely increasing, priorities, should be directed for further progress in understanding and addressing the links between resource quality, agricultural productivity and food security including targeted improvements in data analysis, technology development and policy.

Weicheng, et al., (2012) examined climate change, land degradation and Food security in Iraq. They observed that degradation is the common problem in dry land environment and has caused reduction of land productivity and cropland abandonment and hence reduction in crop yield.

Desertification and Food Security

Mohammed, (2015) examined desertification in northern Nigeria with focus on its causes and implications for National food security. He sees desertification to be visible in eleven states in northern Nigeria and its effect is very glaring on the agricultural sector. Farmers have been deprived of farm lands by sand dunes, inadequate water as most of the sources have shrank in volume, low income among others. He highlighted the consequences of desertification to include conflict, security threat, poverty, corruption, policy inconsistency, technology, and food supply. The study concluded that the effect of desertification on the frontline state is devastating with

serious implications on food production which is exacerbated by shrinking water levels in dams and other irrigation bodies in the areas and above all recommended that as agriculture has transcended from development strategy to Agric business, the private sector should partner with government and non-government organisation to make the best of the situation. Government should intensify efforts in the Public Private Partnership (PPP) between local and foreign companies. This partnership could import some necessary technology that could be used to harness some benefits from desertification: especially with Israel that has made a breakthrough in agriculture in the desert.

Theoretical Framework

Utility Theory

This theory provides a methodological framework for the evaluation of alternative choices made by individuals, firms and organizations. Utility refers to the satisfaction that each choice provides to the decision maker. Thus, this theory assumes that any decision is made on the basis of the utility maximization principle according to which the best choice is the one that provides the highest utility (satisfaction) to the decision maker.

Utility theory is often used to explain the behaviour of individual consumers. In this case the food crop farmer plays the role of the decision maker that must decide how much each of the many available climate change adaptation strategies to use so as to secure the highest possible level of total utility subject to his or her available income, prices, and other factors. The traditional framework of utility theory has been extended over the past three decades to multi-attribute case, in which decisions are taken by multiple criteria. In all cases the utility that the decision maker (i.e. food crop farmer) gets from selecting a specific choice of climate change adaptation strategy is measured by a utility function U , which is a mathematical representation of the decision maker's (food crop farmer) system of preferences such that: $U(x_1) > U(x_2)$, where choice of climate change adaptation x_1 is preferred over choice x_2 or $Ux_1 = Ux_2$, where choice x_1 is indifferent from choice x_2 -both choices are equally preferred. The climate change adaptation strategies adopted by the food crop farmers will be modelled into stochastic frontier models to determine their technical and profit efficiency levels in their food crop production activities in south-western Nigeria and those strategies that can lend themselves to policy formulation will be simulated to see their effects on the efficiency levels.

METHODOLOGY

The study adopted the survey research design employing a five-point Likert scale questionnaire. This questionnaire was subjected to reliability tests using the Cronbach alpha and the result obtained indicated that all the latent constructs scored alpha values above 0.60 which is the minimum recommended by Sekaran, (2003). The population of the consist of 99 staff of three (3) farms in FCT, Abuja (Okon Farms in Abuja Municipal, 18; Premium farms in Kuje, 56; Provider farms in Gwagwalada, 25). Considering the small size of the population, the study adopted a census sampling technique which allows for the selection of the entire population as sample size, hence the sample size is 99. Copies of the questionnaire were distributed to the respondents with the help of research assistants. The study applied the multiple regression analysis to analyze the data collected from the respondents. The model for the ordinary least square multiple regression analysis is depicted below:

$$FS = \beta_0 + \beta_1 ED + \beta_2 DS + e$$

Where: FS = Food security, ED = Environmental degradation, DS = Desertification, β_0 = Intercept/Slope, $\beta_1 \beta_2$ = Coefficient of the independent variables, e = error term (5%).

RESULTS AND DISCUSSIONS

Table 1: Gender Distribution of Respondents

Gender	Frequency	Percentage
Female	18	18
Male	81	82
Total	99	100

Source: Field Survey, 2021

Table 6 above displays the gender distribution of the respondents of the study. This shows that of the total ninety-nine (99), eighty-one (81) of the respondents constituting 82% were male while the other eighteen (18) respondents constituting 18% were female, implying that the larger proportion of respondents who took part in the survey were males.

Table 2: Age Distribution of Respondents

Age Distribution	Frequency	Percentage
18-30	37	37
31-40	42	42
41-50	11	11
50 and Above	09	10
Total	99	100

Source: Field Survey, 2021

Table above shows that of 37 (37%) the respondents were between 18 to 30 years old; while 42 (42%) of the respondents were between 31 to 40 years old; 11 (11%) of the respondents were between 41 to 50 years old while the remaining 9 (10%) respondents were 50 years old and above. The result implies that majority of the people in the study area were young below forty years old with the largest group being between 31-40 years old and none of the respondents was a minor, meaning they all had the maturity to partake in the survey.

Table 3: Educational Qualification

Educational Qualification	Frequency	Percentage
FSLC	29	29
WASC/SSCE/NECO	49	49
OND/ND	10	10
HND/BSc	11	12
Total	99	100

Source: Field Survey, 2021

From the table above, we can clearly see that out of the 99 sampled respondents, in response to the educational qualification distribution question, 29 (29%) respondents had only first school leaving certificates (FSLC), 49 (49%) respondents stated that they were WASC/SSCE/GCE Holders; 10 (10%) respondents said they were OND/ND holders; 11 (12%) stated that their educational qualification is of the HND/BSc category. This implies that the respondents were generally educated and had the ability to understand the aim and content of the survey to effectively partake in it.

Table 4: Marital Status of Respondents

Marital Status	Frequency	Percentage
Single	28	28
Married	63	64
Divorced	8	8
Total	99	100

Source: Field Survey, 2021

Table above shows that 28(28%) of the respondents were of the single category. 63(63%) of the respondents were of the married category. Divorced category consisted of 8 (8%) respondents out of the total sampled respondents.

Table 5: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ED	99	1	4	2.35	.517	.431	.172	-.727	.342
DS	99	1	3	2.43	.588	-.453	.172	-.680	.342
FS	99	1	4	2.90	.675	-.167	.172	-.093	.342
Valid N (listwise)	99								

Source: SPSS Output, 2021

Data on the study variables were described in table 1 above in terms of the mean, minimum, maximum, standard deviation, skewness and kurtosis values. Environmental degradation (ED) revealed an average value of 2.35 with a standard deviation value of 0.517. however, the minimum and maximum values stood at 1 and 4 respectively. Desertification (DS) had minimum and maximum values of 1 and 3 respectively however, it showed an average of 2.43 along with a standard deviation of 0.588. Furthermore, food security (FS) showed a minimum value of 1 and a maximum value of 4 with an average value of 2.90 accompanied with a standard deviation value of 0.675. All the skewness and kurtosis values were less than 1 which suggest that the data were normally distributed (Lumley, et al., 2002).

Table 6: Correlations

		ED	DS	FS
ED	Pearson Correlation	1	.652**	-.316**
	Sig. (2-tailed)		.000	.000
	N	99	99	99
DS	Pearson Correlation	.652**	1	-.093
	Sig. (2-tailed)	.000		.216
	N	99	99	99
FS	Pearson Correlation	.316**	.093	1
	Sig. (2-tailed)	.000	.216	
	N	99	99	99

Source: SPSS Output, 2021

ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	94.374	2	23.594	22.213	.000 ^b
Residual	182.688	96	1.062		
Total	277.062	98			

a. Dependent Variable: FS

b. Predictors: (Constant), ED, DS

Environmental degradation (ED) showed a moderate relationship with desertification (DS) which stood at 0.652 and was significant at 1% while it (ED) with a value of -0.316 indicated a weak negative and significant relationship with food security (FS) at 1%. The relation between DS and FS was even weaker with a value of -0.093 signifying a negative but significant relationship. The relationship between ED and DS stood at 0.652 which is below the threshold for multicollinearity to occur. Multicollinearity is a situation where two independent variables are very strongly related thereby indicating that one can perform the function of the other. The threshold is usually pegged at 0.80 and above.

Regression Analysis

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.584 ^a	.341	.325	1.031	2.179

a. Predictors: (Constant), ED, DS

b. Dependent Variable: FS

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	1.216	.402		3.029	.003		
ED	-.305	.097	-.303	-3.150	.002	.415	2.409
DS	-.618	.082	-.507	-7.544	.000	.847	1.180

a. Dependent Variable: FS

The result, as shown in the tables above revealed an R-square value of 0.341 which implies that 34.1% of the variation in food security (FS) could be explained by the combination of environmental degradation (ED) and Desertification (DS). The remaining 65.9% variation could be explained by other factors not included in this study. The f-statistics stood at 22.213 and also the probability of the f-statistics was found to be significant at 5% level of significance ($p < 0.000 < 0.05$) which therefore, indicates that the model is fit to measure the association between the variables under study.

The regression line $FS = 1.216 - 0.305ED$ indicates that an increase in environmental degradation will lead to a 0.305 decrease in food security with statistical significance. The probability of t-statistics stood at 0.002 which is less than 0.05 level of significance and as such the study rejects the null hypothesis and accept the alternative hypothesis which states that environmental degradation has significant effect on food security in FCT, Abuja.

The regression line $FS = 1.216 - 0.618DS$ indicates that an increase in desertification will lead to a 0.618 decrease in food security with statistical significance. The probability of t-statistics stood at 0.00 which is less than 0.05 level of significance and as such the study rejects the null hypothesis and accept the alternative hypothesis which states that desertification has significant effect on food security in FCT, Abuja.

Discussion

The study found from the test of the first hypothesis that environmental degradation has negative effect on food security implying that food security decreases with increase in environmental degradation. This could further insinuate that as environmental factors such as land are being mutilated, the prospects of having ceaseless supply of food which guarantees food supply to individuals, households and at national level is threatened. This finding agrees with that of Atef and Adel, (2014) and Weicheng, et al., (2012) who both found land degradation to have a negative influence on crop yield and food security. Similarly, the study found from the second hypothesis that desertification has negative and significant effect on food security. This implies that the more increase in desert encroachment either by natural or man-made factor, crops lives are susceptible which could result in poor harvest resulting in food insecurity. The finding also aligns with that of Mohammed, (2015) who found crop yield as being threatened by desertification.

Conclusion and Recommendations

Drawing inference from the findings of the study, the study concludes that environmental degradation and desertification negatively affect food security in FCT, Abuja. It concludes also that increase in any of the factors listed above will lead to decrease in food security in Abuja. Based on the foregoing, the study recommends that government at all levels through relevant agencies should strive to prevent desertification by mandating every citizen to plant five trees for every one tree brought down. Also, government must ensure implement policies that prevents activities capable of causing damage to any part of the ecosystem.

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