Impact of Environmental Degradation on Arable Crop Yield and Area in Abia State of Nigeria

Onwuchekwa raphael Iheke[1], Cliff Chilasa Agbaeze[2]

Department of Agricultural Economics
Michael Okpara University of Agriculture, Umudike
P. M. B. 7267, Umuahia, Abia State, Nigeria
raphakwas@yahoo.com, iheke.onwuchekwa@mouau.edu.ng

Abstract: Land degradation, a loss of actual or potential productivity or utility as a result of natural or anthropic factors, is the decline in land quality or reduction in its productivity. In the context of productivity, land degradation results from a mismatch between land quality and land use (Beinroth *et al.,* 1994). Mechanisms that initiate land degradation include physical, chemical, and biological processes (Lal, 1994). Important among physical processes are a decline in soil structure leading to crusting, compaction, erosion, desertification, anaerobism, environmental pollution, and unsustainable use of natural resources. Significant chemical processes include acidification, leaching, salinization, decrease in cation retention capacity, and fertility depletion. Biological processes include reduction in total and biomass carbon, and decline in land biodiversity. Thus, it has become necessary to investigate the impact of land degradation on arable crop yield and area in Abia state of Nigeria. This is the thrust of this paper. This is given to the fact the State is bedevilled with serious environmental problems especially land degradation caused by erosion. A simple random sampling technique was used in selecting the respondents used for the study. Data collected using structured questionnaire and interview schedules were analyzed used such statistical tools as frequency distributions, percentages, means and t-test statistic. Results of data analysis revealed a decline in yield byf 3987.6kg and area cultivated by each farmer by 0.43ha (a loss of 25.8ha by the entire sampled farmers). It was recommended that for the country to achieve national self-sufficiency in production and meet the goal of reducing poverty and hunger there should be increased efforts towards educating the farmers to avoid practices that would lead to land degradation and especially on the need to adopt sustainable farming practices such as crop rotation which reduces the incidence of land degradation and improve yield per unit of cultivated area.
[Onwuchekwa raphael Iheke, Cliff Chilasa Agbaeze. **Impact of Environmental Degradation on Arable Crop Yield and Area in Abia State of Nigeria.** *World Rural Observ* 2017;9(4):82-87]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). http://www.sciencepub.net/rural. 13. doi:10.7537/marswro090417.13.

Keywords: Environmental degradation, arable crop, yield, area

1. Introduction

Land degradation will remain an important global issue for the 21st century because of its adverse impact on agronomic productivity, the environment, and its effect on food security and the quality of life (Eswaran *et al,* 2001). They noted that productivity impacts of land degradation are due to a decline in land quality on site where degradation occurs (e.g. erosion) and off site where sediments are deposited. Soil degradation is a serious problem in Nigeria (World Bank, 1990). Deforestation, soil erosion, desertification, soil salinization, alkalinization and water-logging, form different but often interrelated aspects of soil degradation (Karshenas, 1994). In Nigeria, soil degradation affects about 50 million people and leads to the greatest loss of GNP (US $3000 million per year) relative to other environmental problems (World Bank, 1990). An estimate by Food and Agricultural Organisation (FAO) in 1984 indicated that 5 to 7 million hectares of land a year are lost globally to agricultural production as a result of erosion and related forms of land degradation, including siltation of water ways and dams.

However, the on-site impacts of land degradation on productivity are easily masked due to use of additional inputs and adoption of improved technology and have led some to question the negative effects of desertification. The relative magnitude of economic losses due to productivity decline versus environmental deterioration also has created a debate. Some economists argue that the on-site impact of soil erosion and other degradative processes are not severe enough to warrant implementing any action plan at a national or an international level. Land managers (farmers), they argue, should take care of the restorative inputs needed to enhance productivity. Agronomists and soil scientists, on the other hand, argue that land is a non-renewable resource at a human time-scale and some adverse effects of degradative processes on land quality are irreversible, e.g. reduction in effective rooting depth. The masking effect of improved technology provides a false sense of security.

Environmental degradation and loss of ecosystem services will directly affect pests (weeds, insects and pathogens), soil erosion and nutrient depletion, growing conditions through climate and weather, as well as available water for irrigation through impacts on rainfall and ground and surface water. These are factors that individually could account for over 50% in loss of the yield in a given "bad" year. The interactions among these variables, compounded by management systems and society, are highly complex. A changing climate will affect evapo-transpiration, rainfall, river flow, resilience to grazing, insects, pathogens and risk of invasions, to mention a few. In the following section we attempt to provide for each variable, rough estimates of how much environmental degradation and loss of some ecosystem services could contribute to reducing yields by 2050. This is based on peer reviewed studies, models and expert judgment, and with the understanding that conditions and estimates vary considerably and relationships are highly complex.

Unsustainable practices in irrigation and production may lead to increased salinization of soil, nutrient depletion and erosion. An estimated 950 million ha of salt-affected lands occur in arid and semi-arid regions, nearly 33% of the potentially arable land area of the world. Globally, some 20% of irrigated land (450,000 km2) is salt-affected, with 2,500–5,000 km2 of lost production every year as a result of salinity (UNEP, 2008). In South Asia, annual economic loss is estimated at US$1,500 million due to salinization (UNEP, 1994).

Nutrient depletion as a form of land degradation has a severe economic impact at the global scale, especially in Sub-Saharan Africa. Stoorvogel et al. (1993) estimated nutrient balances for 38 countries in Sub-Saharan Africa. Annual depletion rates of soil fertility were estimated at 22 kg nitrogen (N), 3 kg phosphorus (P), and 15 kg potassium (K) per ha. In Zimbabwe, soil erosion alone results in an annual loss of N and P totalling US$1.5 billion. In South Asia, the annual economic loss is estimated at US$600 million for nutrient loss by erosion, and US$1,200 million from soil fertility depletion (Stocking, 1986; UNEP, 1994).

Sub-Saharan Africa is particularly impacted by land degradation. In Kenya, over the period 1981–2003, despite improvements in woodland and grassland, productivity declined across 40% of cropland – a critical situation in the context of a doubling of the human population over the same period (Bai and Dent, 2006). In South Africa, production decreased overall; 29% of the country suffered land degradation, including 41% of all cropland; about 17 million people, or 38% of the South African population, depend on these degrading areas (Bai and Dent, 2007).

Abia State is one of the states worst hit by erosion and other environmental challenges in the country. This has affected the socio-economic life of the people of the state especially with reference to agricultural production aand productivity. Thus, it has become necessary to assess the impact of environmental degradtion on crop yield and area in Abia State of Nigeria. The study also investigated on measures adopted by the households to mitigate the effects of environmental degradation.

2. Methodology

This study was carried out in Abia State of Nigeria. Abia state lies within approximately latitude $4^o40'$ and $6^o14'$ North and longitudes 7^o10 and 8^o east. It covers an area of about 5,243.75 square kilometers and has a population of about 2,833, 999 million people (FRN, 2007; NPC, 2006). The predominant occupation of the inhabitants is farming.

A simple random sampling technique was used in selecting the respondents used for the study. Two Agricultural Zones were randomly selected out of the 3 in the State. Two Local Government Areas were randomly selected from each Agricultural Zone, from which 3 communities were selected. The list of crop farmers in each chosen community formed the respective sampling frames from which 10 crop farmers each were randomly selected. In all, 120 respondents were used for the study.

Data collected using structured questionnaire and interview schedules were analyzed used such statistical tools as frequency distributions, percentages, means and t-test statistic.

3. Results and Discussion

i. Socio-economic characteristics of the farmers

The socio-economic characteristics of the farmers were presented in Table 1. These include age, marital status, household size, level of formal education, years of farming experience, size of farmland, visitation by agricultural extension agents, major sources of farmland, and number of social/cooperative associations they belong to.

Table 1 show that about 73.33 percent of the farmers were under 60 years of age. The mean age was 51 years. This is similar to Iheke (2006) who reported about 88.73 percent and 98.53 percent of men and women rice farmers as being under 60 years of age, with mean ages of 46 and 43 years. This result implies that the farm households are ageing and that younger people are no longer going into farming. Odii and Nwosu (1996) reported the mean age of 45 years, while Nwaru and Ekumankama (2002) reported mean ages of 42 years and 49 years for men and women crop farmers respectively. However, the result shows that the bulk of the farmers are still energetic and should be reasonably enterprising. As noted by Nwaru (2004), the risk bearing abilities and innovativeness of a farmer, his mental capacity to cope with the daily challenges and demands of farm production activities and his ability to do manual work decrease with advancing age.

The Table shows that 60 percent of the farm households were headed by men. This is typical in the study area where the man, most often the husband, takes major decisions concerning the household except where he is no longer alive. On the other hand, the bulk of the respondents (70 percent) were married. The result implies that majority of the farm households are stable. According to Nwaru (2004), this stability should create conducive environments for good citizenship training, development of personal integrity and entrepreneurship, which are very important for efficient use of resources.

The household size distribution show that 56.67 percent of the respondents had a household size of between 6-10 persons and the mean household size was about 7 persons per household. This is consistent, desirable and of great importance in farm production as rural households rely more on members of their households than hired workers for labour on their farms. According to Nwaru (2004), this is so if members are not made up of the aged and very young people, otherwise scarce capital resource that should have been employed for farm production would be channeled for the upkeep of these dependent household members.

The distribution of the respondents according to their level of formal education summarized and presented in Table 1 shows that 91.67 percent of the respondent farmers had one form of formal education or the other ranging from primary to tertiary education. This implies that the bulk of the farmers were literate. This is desirable because according to Obasi (1991), the level of education of a farmer not only increases his farm productivity but also enhances his ability to understand and evaluate new production techniques. This result departs markedly from the findings Jaja *et al* (1998) and Nwaru (2001) who noted that the Nigerian agricultural landscape is characterized among other things by numerous isolated smallholder farm operators, the overwhelming majority of whom cannot read or write.

Table 1: Socio-economic distribution of the respondents

Socio-economic features	Frequency	Percentage
Age range		
30-39	10	16.67
40-49	20	33.33
50-59	14	23.33
60-69	12	20.00
70-79	4	6.67
Mean	51.17	
Sex		
Male	36	60
Female	24	40
Marital status		
Single	4	6.67
Married	42	70.00
Separated	3	5.00
Divorced	2	3.33
Widowed	9	15.00
Household size		
1-5	22	36.67
6-10	34	56.67
11-15	4	6.67
Mean	6.5	
Level of formal education		
No formal education	5	8.33
Primary	28	46.67
Secondary	16	26.67
Tertiary	11	18.33
Farming experience		
1-10	11	18.33
11-20	32	53.33
21-30	9	15.00
31-40	4	6.67
41-50	4	6.67
Mean	18.5	
Source of farm land		
Inheritance	40	66.67
Purchase	39	65.00
Leasehold/rent	13	21.67
Farm size		
0.1-2.0	28	46.67
2.1-4.0	20	33.33
4.1-6.0	7	11.67
6.1-8.0	4	6.67
8.1-10.0	1	1.67
Mean	2.72	
Extension contact		
Contact	24	40.00
No contact	36	60.00
Source of fund		
Personal savings	33	55.00
Friends and relatives	60	100.00
Cooperatives/associations	27	45.00
Banks	10	16.67
Local money lenders	6	10.00

Source: Survey data 2009

On the years of farming experience, the result shows that on the average, the respondents has spent about 19 years in arable crop farming. The result has some positive implications for increased productivity because according to Nwaru (2004), as the number of years a farmer has spent in the farming business may give an indication of the practical knowledge he has acquired on how he can overcome certain inherent farm production problems. This includes declining soil fertility and degradation.

The distribution of the respondents based on their sources of farm land revealed that the major source of farm land for both households was inheritance, followed by purchase. Thus, owner occupier forms the major land tenureship system, which implies tenure security. Iheke and Echebiri (2010) noted that insecurity of tenure associated with leasehold or renting of land serves as disincentive to farmers from investing meaningfully on the land (especially in degradation control measures) since the land goes back to the owner after the cropping season. As noted by Macours *et al* (2004), insecure property rights over land not only reduce sharply the level of activity on the land but also lead to matching in the tenancy market along socio-economic lines and hence limit severely access to land for the rural poor.

Table 1 revealed that 80 percent of the respondents cultivated between 0.1 – 4 hectares. The mean hectarage cultivated by the farmers was 2.72ha. This result is consistent with the findings Iheke and Nwaru (2009) who reported 2.75 ha and 2.15 ha respectively for men and women cassava farmers. These farms are usually small-sized, fragmented and scattered and not contiguous land holdings. According to Nwaru (2004), this thus poses a great challenge to the much-desired agricultural modernization/mechanization and commercialization in Nigeria and therefore depicts the need for urgent land reform policies and programmes that would give farmers access to more contiguous land holdings for increased agricultural production.

The Table also revealed that only 40 percent of the respondents had contact with extension agents during the cropping season. This implies that the farmers were not substantially exposed to technical innovation; a measure if reversed would increase their productivity through amelioration of environmental degradation. Iheke (2006) noted that as change agents, extension workers serve as channels for diffusion of technical innovations. On the other hand, the major source of fund for the respondents was from friends and relatives. This is followed by personal savings and loans from cooperatives. Only 10 percent of the respondents obtained their fund for farming from banks. This may be as a result of the stringent conditions associated with bank lending. Also, most farmers lack suitable collateral to qualify them for bank lending.

ii. Impact of degradation on crop yield and area

The impact of degradation on crop yield and area are ascertained by estimating the yield of crops and the area cultivated by the farmers before and after degradation respectively. The results are presented in Table 2 and 3. The outputs of the arable crops were converted into a common measure in kilogrammes using the grain equivalent conversion table (Olayemi, 1986). The result in Table 2 revealed a decline in yield byf 3987.6kg as a result of land degradation. This implies a huge loss of income to the farmer and makes the match towards achieving self-sufficiency in food production difficult. The World Bank (1990) reported that soil degradation led to a loss of US $3000 million per year in Nigeria, the greatest loss of gross national product.

Table 2:Impact of degradation on crop yield

Crops	Yield ($kgha^{-1}$) Before degradation	After degradation	Change in yield
Yam	7350	5152	2198
Cassava	4200	2910	1290
Rice	3255	2520	735
Maize	4500	3110	1390
Cocoyam	3500	2160	1340
Melon	1840	1450	390
Total	14544.5	10556.9	3987.6

Source: Survey data, 2010

According to Eswaran *et al* (2001), yield reduction in Africa due to past soil erosion may range from 2 to 40%, with a mean loss of 8.2% for the continent. In South Asia, annual loss in productivity is estimated at 36 million tons of cereal equivalent valued at US$5,400 million by water erosion, and US$1,800 million due to wind erosion. It is estimated that the total annual cost of erosion from agriculture in the USA is about US$44 billion per year, i.e. about US$247 per ha of cropland and pasture. On a global scale the annual loss of 75 billion tons of soil costs the world about US$400 billion per year, or approximately US$70 per person per year. These losses had made the rise out of poverty by the farmers difficult. However, the on-site impacts of land degradation on productivity are easily masked due to use of additional inputs and adoption of improved technology.

The impact of land degradation on cultivated area (Table 3) shows that there was a decline in the area cultivated by each farmer by 0.43ha. This implies that the total area lost by the sampled 60 farmers was 25.8ha. These losses were due to erosion and deposition of sediments by flood. This problem is exacerbated by rapid urbanization and population growth rate. Iheke and Nto (2009) noted that high population density, growth rate and the relative proximity of urban population to farming land may be the root cause that contributes to loss of agricultural lands and increased agricultural intensification. Population pressure has produced a land use and quality of life problem, using up large amount of fringe areas with loss of agricultural and ecological benefits (Pearce *et al,* 2000).

Table 3: Impact of degradation on area

Area cultivated/farmer		Change in area
Before degradation	**After degradation**	
3.15	2.72	0.43

Source: Survey data, 2010

4. Conclusion

It could be concluded from this study that degradation of the land resource is a major cause of decline in productivity, leading to reduced yield and area cultivated area of land. Therefore, it was recommended that for the country to achieve national self-sufficiency in production and meet the goal of reducing poverty and hunger there should be increased efforts towards educating the farmers to avoid practices that would lead to land degradation. Efforts at increasing crop production and yield and environmental conservation should involve policies that strengthen educating the farmer on the need to adopt sustainable farming practices such as crop rotation which reduces the incidence of land degradation and improve yield per unit of cultivated area, especially agricultural education on conservation practices. In this guise, the extension system should be tailored to meet the information other felt needs of the farmers.

Corresponding Author:
Dr. Onwuchekwa Raphael
Department of Agricultural Economics
Michael Okpara University of Agriculture, Umudike
P. M. B. 7267, Umuahia, Abia State, Nigeria
e-mail: raphakwas@yahoo.com,
iheke.onwuchekwa@mouau.edu.ng

References

1. Beinroth, F.H., Eswaran, H., Reich, P.F. and Van Den Berg, E. (1994). Land related stresses in agroecosystems. In: *Stressed Ecosystems and Sustainable Agriculture,* eds. S.M. Virmani, J.C. Katyal, H. Eswaran, and I.P. Abrol. New Delhi: Oxford and IBH.
2. Lal, R. (1994). Tillage effects on soil degradation, soil resilience, soil quality, and sustainability. *Soil Tillage Research,*27, 1–8.
3. Eswaran, H., R. Lal and P.F. Reich (2001) Land degradation: an overview. In: Bridges, E.M., I.D. Hannam, L.R. Oldeman, F.W.T. Pening de Vries, S.J. Scherr, and S. Sompatpanit (eds.). Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification, Khon Kaen, Thailand. Oxford Press, New Delhi, India. World
4. Bank (1990) Towards The Development of An Environmental Action Plan for Nigeria, West Africa Department.
5. Karshenas, M. 1994. 'Environment, Technology and Employment: Towards a New Definition of Sustainable Development', Development and Change, 25(4):724-756.
6. FAO (1984). Keeping the land Alive: Soil Erosion – its causes and cures. (E.F.S). FAO Soils Bulletin No. 50.
7. UNEP (2008). In Dead Water. Merging of Climate Change With Pollution, Over-Harvest, and Infestations in the World's Fishing Grounds. UNEP/GRID-Arendal, Arendal, Norway.
8. UNEP (1994) Land Degradation in South Asia: Its Severity, Causes and Effects upon the People. INDP/UNEP/FAO. World Soil Resources Report 78. FAO, Rome.
9. Stoorvogel, J. J., E. M. A. Maling, B. J. Jansen (1993) Calculating soil nutrient balances in Africa at different scales. I. Supra-national scale. *Fertilizer Research,* 35, 227–235.
10. Stocking, M. (1986). The cost of soil erosion in Zimbabwe in terms of the loss of three major nutrients. Consultant's Working Paper No. 3., Soil Conservation Programme. Rome, FAO Land and Water Division.
11. Bai, Z.G and Dent, D.L. (2006). Global Assessment of Land Degradation and Improvement: pilot study in Kenya. Report 2006/01, ISRIC – World Soil Information, Wageningen.
12. Bai, Z.G. and Dent, D.L. (2007). Land degradation and improvement in South Africa. 1. Identification by remote sensing. Report 2007/03, ISRIC – World Soil Information, Wageningen.
13. Federal Republic of Nigeria Official Gazette (2007) "Legal notice on Publication of the details of the National and State provisional totals: 2006 census" Retrieved 2007-05-19.
14. Nigerian Population Commission (NPC) (2006) 2006 Nigerian Census Figures. Nigerian Population Commission, Abuja.

15. Iheke, O. R. (2006) Gender and Resource Use Efficiency in Rice Production Systems in Abia State of Nigeria. MSc Thesis, Michael Okpara University of Agriculture, Umudike.
16. Odii, M.C.A. and A.C. Nworu (1996) "Cost and Returns of Rice Production under Alternative Production Systems, *Journal of Modeling, Measurement and Control,*13 (1 & 2), AM. SE Tassin, France.
17. Nwaru J.C. and O. O. Ekumankama (2002) *Economics of Resource Use by Women Arable CropFarms in Abia State.* Research Report Submitted to the Senate Grant Committee, Michael Okpara University of Agriculture, Umudike, December 40 Pp.
18. Nwaru, J.C. (2004) *Rural Credit Markets and Resource Use in Arable Crop Production in Imo State of Nigeria.* PhD Thesis Michael Okpara University of Agriculture, Umudike.
19. Obasi, P. C. (1991) *Resource Use Efficiency in Food Crop Production: A Case Study of the Owerri Agricultural Zone of Imo State, Nigeria.* M.Sc Thesis, University of Ibadan, Ibadan, Nigeria.
20. Jaja, J. S, E. C. Chukwuigwe and D. I. Ekine (1998) "Stimulating Sustainable Agricultural Development through Youth Mobilization Schemes: A Case of school-to- Land Programme in Rivers state, Nigeria" *Sustainable Investment in Nigeria*. Nwosu, A. C. and J. A. Mbanasor (eds) proceedings of the 13th Annual conference of Farm Management Association of Nigeria, Alphabet Nigeria Publishers, Owerri, pp 294-301.
21. Nwaru J.C. (2001) "Stimulating, Entrepreneurship in Nigerian Farms through Sustainable Agricultural Extension Service Delivery in Nigeria: Prospects and Questions, Olowu, T.A. (ed), Proceedings of the 7th National Conference of *Agricultural Extension Society of Nigeria* 19 - 22 August. Pp 19-27.
22. Iheke, O. R. and R. N. Echebiri (2010) Rural land tenancy and resource use efficiency of cassava farmers in South Eastern Nigeria, *Journal of Food and Fibre Production, Vol. 3(1)455-465.*
23. Iheke, O. R and J. C. Nwaru (2009) Gender, farm size and relative productivity of cassava farmers in Ohafia Agricultural Zone of Abia State, Nigeria. *Nigerian Journal of rural sociology Vol. 9 (1): 69-75.*
24. Iheke, O. R. and P. O. Nto (2009) Effects Of Population Pressure/Urbanization On The Adoption Of Sustainable Agricultural Practices By Farmers: A Case Of South Eastern Nigeria, *Journal of Food and Fibre Production, Vol. 3(1) 543-549.*
25. Pearce, D., E. Barbier, and A. Markandya (2000) *Sustainable Development Economics and Environment in the Third World.* London: Earthscan.

12/24/2017