

# Impact of Gas Flaring on Agricultural Production of Edo Esit-Eket Local Government Area, Akwa Ibom State, Nigeria

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**Abstract**— This study investigates the impact of gas flaring on agricultural productivity in Edo Esit-Eket Local Government Area of Akwa State, Nigeria. The study adopted survey research design. A structured questionnaire was generated from the literature and developed for the study. Two hundred and fifty questionnaires were administered to the respondents by the researcher and analyzed using figures and percentages. The findings from the study revealed that gas flaring has impacted negatively on agricultural productivity. The temperature of the flaring was also taken at the control room of the company. Mean monthly temperature of the area was collected to see the temporal variation of temperature. Based on the deduction from the graph of mean monthly air temperature of the study area the surface temperature has increased within the vicinity of Edo gas flare when compared with the mean normal daily temperature. Hence the thermal equilibrium has been altered. This increase in temperature has enormous influence on the socio-economic lives and activities of the inhabitants. Some of the general effects of the gas flared as observed within Edo include the stunted growth of cassava, plantain, palm trees, yams and other crops planted within the flare area. There was also peculiar coloration of leaves into brownish red. Destruction of natural vegetation, irritations of human eyes and bodies, vibration of buildings, contamination of soil and water bodies was also experienced. It is recommended that gas flaring should be immediately banned. The gases should be collected and put to use for powering electricity generation devices or liquefied and bottled for domestic and industrial purposes. The Environmental Law Enforcement Agencies, especially DPR (Department of Petroleum Resources), should be more involved in enforcing all existing environmental laws on gas flaring so as to ensure the well-being of the community.

**Keywords**— Gas flaring, impact, agricultural production.

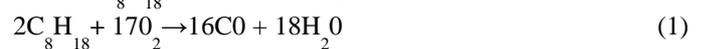
## I. INTRODUCTION

The development of technology has led to the exploration of man's environment in a bid to increasing his standard of living. This exploration includes oil drilling which in turn leads to gas flaring. Gas Flaring in the oil-rich Niger Delta Region of Nigeria continues to degrade the environment, affecting human, animal and plant lives. Even inanimate objects are affected (Nta *et al.* 2016). Within Edo community in Esit-Eket Local Government Area of Akwa Ibom State, increase in temperature of the atmosphere, greenhouse effect, acid rain/acidification of aquatic environment, poor agricultural yields and changes in the ecosystem etc. have been mentioned as some of the adverse effects.

Gas flaring leads to emission of carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO) and a variety of air pollutants, such as

volatile organic compounds (which include carcinogen and air toxics) nitrogen oxides (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>), toxic heavy metals and black carbon soot (Kearns *et al.* 2000; Schwartz and White 1997). In addition to vehicular traffic emissions (CO<sub>x</sub>, HC, NO<sub>x</sub>, SO<sub>2</sub> and particulate matters), emission from gas flaring and venting systems in the oil-producing Niger Delta mainly contribute to atmospheric pollution in South-South geopolitical Zone of Nigeria (Ajao and Anuriwo 2002; Scheren *et al.* 2002).

Products of gas flaring are the gases that are emitted during gas flaring due to complete and/or incomplete combustion of carbon compounds which are harmful to communities. These include: Carbon II oxide produced by incomplete combustion process of carbon compounds such as octane (C<sub>8</sub>H<sub>18</sub>) as shown in Equation 1 (Julius, 2011b);



Before the discovery of oil in the Niger Delta, the people depended so much on the resources from their natural environment. They made their living from the exploitation of the resources of their land, water and forest as farmers, fishermen and hunters. They were attached to their environment. At that period agricultural growth was related to flourishing rural economy thereby improving the standard of living of the rural farmers. Agriculture production is very low compared to what it used to be in the past. Agricultural growth has seriously declined over the past two decades and as a result, affecting the standard of living of the farmers. Therefore to improve the standard of living of farmers, there is need to identify the likely impact that has caused a reduction in agricultural productivity.

However, the activities of gas flaring have constituted great environmental and social problems in Edo, its enormous economical benefits notwithstanding. One of the major problems is the destruction of the people's livelihood which is the soil and farmlands. Gas flaring affects the soil, vegetation, agriculture and crop production (Alakpudia, 1989, 2000; Dosunmu and Amadi, 1996; Gogoi and Baruah, 2002; Ogidiolu, 2003; Efe, 2003). The agricultural soils as well as fresh water and aquatic life have been destroyed by various forms of gas generated environmental pollution. Farming has become very difficult and even drinking water has become scarce. Flaring activity affects agricultural production of Edo. This stunts crops growth and impacts negatively on the yield of their crops such as, cassava, yam, plantain, banana and

palm trees among others. The specific objective of this study is to examine and ascertain as well as to make information available on the effects of gas flaring on agricultural production of Edo in Esit-Eket, where there is dearth of information presently.

## II. MATERIALS AND METHODS

### Study Area

Edo is situated in Esit-Eket Local Government Area of Akwa Ibom State, Nigeria, its geographical coordinates are 4° 39' 20.22" North 8° 3' 46.39" East / 4.655616 North 8.062886" East. This city has a tropical climate. Edo has significant rainfall most months, with a short dry season that has a little impact. This climate is considered to be Am according to the Köppen Geiger climate classification. The average annual temperature in Edo Esit-Eket is 26.4°C. Precipitation here averages 3044mm.

### Sample Collection

This study made use of survey method. The survey sampled the opinion of Edo people on the effect of gas flaring on agricultural production. The method involved the use of structured questionnaires which were administered to the respondents by the researcher. This work derived its information or data from both primary and secondary sources of data collection. The primary source of data collection includes: questionnaires design and administration, personal observation and oral interview. On the other hand, secondary source of data collection include the use of relevant materials from journals, conferences, periodicals, internet. The temperature of the flaring was taken at the control room of the company. Mean monthly temperature of the area was collected from the study area to see the temporal variation of temperature. Visual observations were made of the vegetation in the area to assess the effects of the environment on the health of the plants

### Data Analysis

The data that were generated from this study were graphically and statistically analyzed. The use of figures was employed to present the data. In addition, the rated responses from the questionnaires were calculated using percentages to obtain the perception of the respondents on the impact of gas flaring on soil fertility and agricultural productivity.

Figure 1 shows the effect of gas flaring on agricultural yields as analyzed using the questionnaire. 82.90% of the respondents strongly agreed that gas flaring lead to poor agricultural yield at a very high rate. 12.50% of the respondents agreed that it has high effect on the yield, while 4.60% of the respondents disagreed on the poor agricultural yield due to gas flaring.

Figure 2 shows the impact of gas flaring on changes in ecosystem such as stunted growth and red leaves as analyzed using the questionnaire. 80.90% of the respondents strongly agreed that gas flaring lead to stunted growth and red leaves at a very high rate. 16.40% of the respondents agreed that it has high effect on stunted growth and red leaves; while 3.63% of

the respondents disagreed on the fact above that the effect is low.

Figure 3 shows the impact of gas flaring on soil fertility as analyzed using the questionnaire. 73.7% of the respondents strongly attest to the fact that gas flaring negatively affects the fertility of the soil at a very high rate. 21.05% of the respondents agreed that the effect is high, while 5.25% of the respondents disagreed on the fact above.

Figure 4 shows the impact of gas flaring on vegetation as analyzed using the questionnaire. 44.73% of the respondents strongly agreed that gas flaring contribute to the scarcity of suitable vegetations, 51.32% of the respondents agreed to that, while 3.95% disagreed on the scarcity of suitable vegetations due to gas flaring.

Figure 5 shows the impact of gas flaring on the percentage of people involvement in farming due to low yield as analyzed using the questionnaire. 27.63% of the respondents strongly agreed that people involved in farming is low, 19.08% of the respondents agreed to that fact, while 53.29% of the respondents disagreed that gas flaring contributed to that.

Figure 6 shows the impact of gas flaring on soil. 84.21% of the respondents strongly agreed to the fact that, Constant heat being emitted from the flare sites makes the soil of the adjacent farmland hard and unproductive. 14.47% of the respondents agreed to this fact, while 1.32% disagreed to the fact that gas flaring contribute to the hard and un-productivity of the soil.

Figure 7 shows the adverse effect of gas flaring on the migration of inhabitants who are mainly farmers to other towns for settlement. 32.34% strongly agreed to fact that, Gas flaring contributes to the migration of farmers to other towns for settlement. 21.71% of the respondents agreed to the fact above, while 46.05% of the respondents disagreed to the fact that gas flaring contribute to the migration of the inhabitants who are farmers to other towns for settlement.

Figure 8 shows the effect of gas flaring on the importation of food crops from other regions due to low crop yield. 42.76% of the respondents strongly agreed to the importation of food crops from other regions. 49.34% of the respondents agreed to the fact above, while 7.89% of the respondents disagreed to the importation of food crops from other regions.

## III. RESULTS AND DISCUSSION

The findings from the study revealed that gas flaring has impacted negatively on soil, soil fertility, ecosystem, scarcity of suitable vegetation as well as crop yield with high percentage of the respondents attesting to this. These impacts are felt much on soil, crop yield, ecosystem and soil fertility etc. Some of the general effects of the gas flared as observed within Edo include the stunted growth of cassava, plantain, palm trees, yams and other crops planted within the flare area. The reason that can be deduced from this is that plantain is therefore expose to constant heat and exposure to light and associated gases 24 hours every day inhibits flowering and fruition. The inhibition is as a result of continuous light without the dark phase of photosynthesis which is responsible for flowering and fruition of crops (Olisemauche and Avwersuoghene 2015). There was also peculiar coloration of

leaves into brownish red. Destruction of natural vegetation, irritations of human eyes and bodies, vibration of buildings, contamination of soil and water bodies was also experienced.

*Effect of Temperature on Socio-Economic Activities*

Figure 9 shows the mean monthly temperature variation in the study area. The mean monthly air temperature of the study area varies between 28.9°C to 33.6°C with mean daily temperature of 26.8°C (Oseji, 2010). The temperature of the flare as on the 5<sup>th</sup> December, 2016 at 01: 33p.m taken at the control room of the flaring site was recorded as 39.84°C. Therefore, the surface temperature has increased within the vicinity of Edo gas flare when compared with the mean normal daily temperature. Hence the thermal equilibrium has been altered. This increase in temperature has enormous influence on the socio-economic lives and activities of the inhabitants.

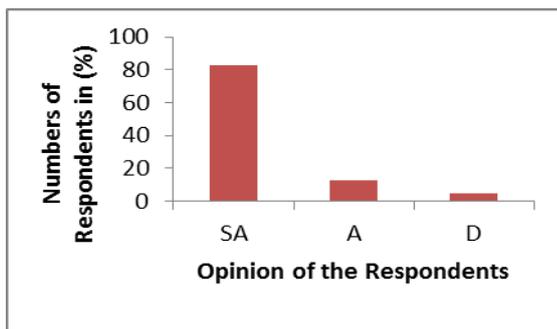


Fig. 1. Effect of gas flaring on crop yield.

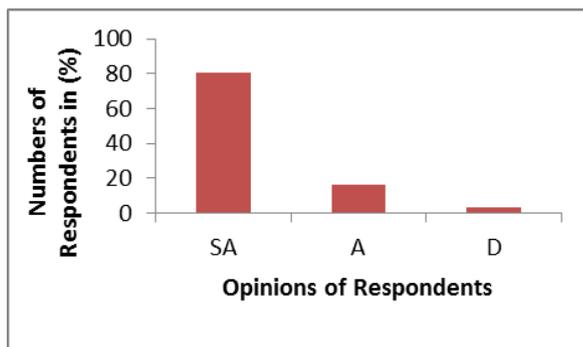


Fig. 2. Effect of gas flaring on ecosystem.

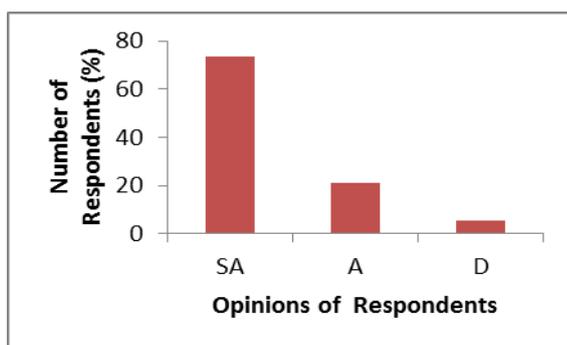


Fig. 3. Effect of gas flaring on soil fertility.

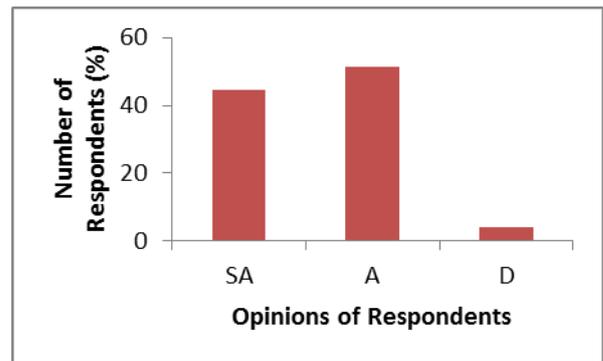


Fig. 4. Effect of gas flaring on vegetation.

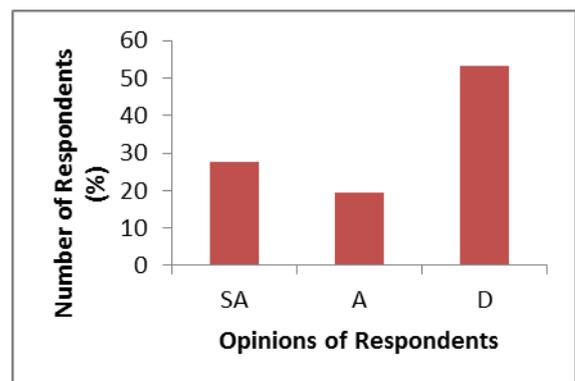


Fig. 5. Effect of gas flaring on involvement in farming due to low yield of crops.

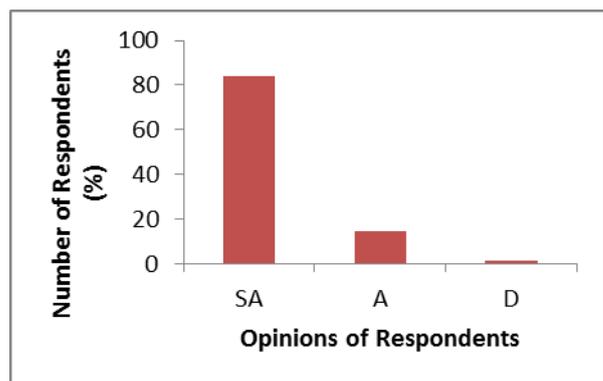


Fig. 6. Effect of gas flaring on adjacent farmland.

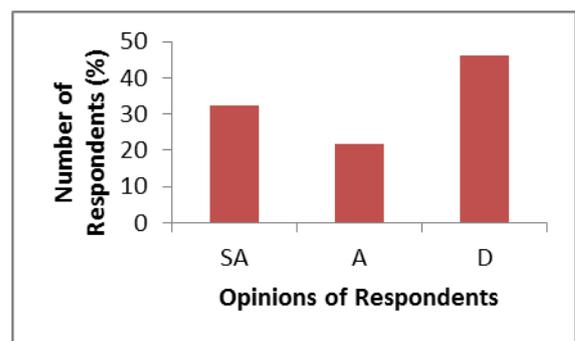


Fig. 7. Effect of gas flaring on the migration of inhabitants to other towns for settlement.

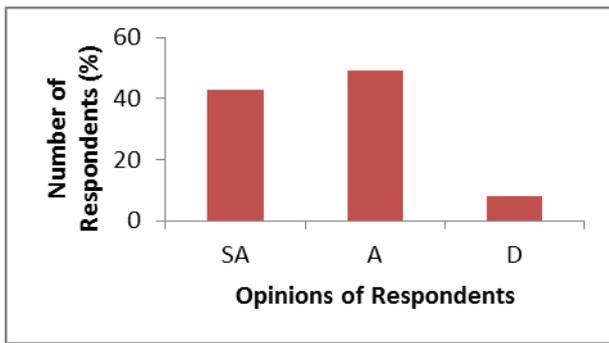


Fig. 8. Effect of gas flaring on food crops.

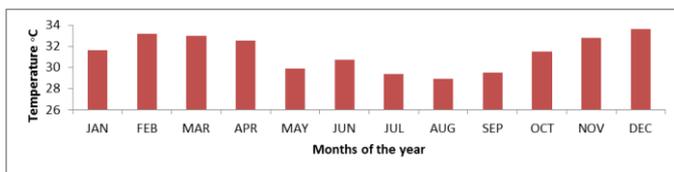


Fig. 9. Temperature variation due to gas flaring.

#### IV. CONCLUSIONS

The data obtained from the analysis of questionnaire show that gas flaring has detrimental effects on soil, soil fertility, ecosystem, scarcity of suitable vegetation as well as crop yield with high percentage of the respondents attesting to this fact. These impacts are felt much on soil, crop yield, ecosystem and soil fertility etc.

Based on the deduction from the graph of mean monthly air temperature of the study area the surface temperature has increased within the vicinity of Edo gas flare when compared with the mean normal daily temperature. Hence the thermal equilibrium has been altered. This increase in temperature has enormous influence on the socio-economic lives and activities of the inhabitants. It is concluded that gas flaring do not only produce excessive heat which alters the temperature of the environment but also causes gaseous pollutants to be present in the environment which has adverse effects on the inhabitants including animals and aquatic lives. As much as the Nigeria oil industry has affected the country positively, by fashioning a markable economic landscape and contributing to foreign exchange, earning, it also has a negative impact on the socio-economic life and the environment of the host communities and its inhabitants. Finally, it is recommended that gas flaring should be immediately banned. The gases should be collected and put to use for powering power generation devices or liquefied and bottled for domestic and industrial purposes. The Environmental Law Enforcement Agencies, especially DPR (Department of Petroleum Resources), should be more involved in enforcing all existing environmental laws on gas flaring so as to ensure the well-being of the community.

#### REFERENCE

[1] C. M. A. Ademoroti, *Environmental Chemistry and Toxicology*. Folidex Press Ltd. Ibadan, pp. 140, 1996.

[2] E. A. Ajao and S. Anurigwo, "Land-based sources of pollution in the Niger Delta, Nigeria," *AMBIO: A Journal of the Human Environment*, vol. 31, issue 5, pp. 442-445, 2002.

[3] J. Alakpodia, "Soil characteristics under gas flare in Niger Delta, Southern Nigeria geo-studies forum," *An Int. J. Environ. Policy* 1, pp. 1-10, 2000.

[4] I. J. Alakpodia, "The Effects of Gas flaring on the Micro-climate and Adjacent Vegetation in Isoko Area of Bendel State," Unpublished M.Sc. Thesis, University of Ibadan, 1989.

[5] A. Dosunmu and B. C. Amadi, "Evaluation of the effect of gas flares on the environment," *Proceedings of the Twentieth Annual International Conference*, The Society of Petroleum Engineers, Nigeria Council, pp. 45-49, 1996.

[6] S. I. Efe, "Effects of gas flaring on temperature and adjacent vegetation in Niger Delta environment," *Int. J. Environ.*, vol. 1, issue 1, pp. 91-101, 2003.

[7] I. Ekpoh and A. Obia, "The role of gas flaring in the rapid corrosion of zinc roofs in the Niger Delta Region of Nigeria," *The Environmentalist*, vol. 30, issue 4, pp. 347-352, 2010.

[8] N. Gogoi and K. K. Baruah, "Effects of natural gas flare on growth, flowering and yield of rice," 2012. <http://www.envfor.nic.in/paryaabs/v19n12/plant.html>.

[9] S. I. Ibaba and Olumati, "Sabotage induced oil spillage and human rights violation in Niger Delta," Paper Presented at the *First Cultural Conference on Nigeria in the 21 Century: Issues and Challenges*, At the Faculty of Administration Obafemi Awolowo University, 2009.

[10] J. Kearns, K. Armstrong, L. Shirvill, E. Garland, C. Simon, and J. Monopolis, "Flaring and venting in the Oil and gas exploration and production industry," An overview of purpose, quantities, issues, practices and trends, vol. 2, International Association of Oil & Gas Producers, London, 2000.

[11] E. E. Nkwocha, and E. C. Pat-Mbano, "Effect of gas flaring on buildings in the oil producing rural communities of River State, Nigeria," *African Research Review*, vol. 4, issue 2, pp. 90-102, 2010.

[12] S. A. Nta, G. O. Jonah, and E. B. Lucas, "Adverse effects of gas flaring on galvanized roofing sheets and some agricultural crops at Mkpanak, Ibeno Local Government Area of Akwalbom State," *International Journal of Scientific & Engineering Research*, vol. 7, pp. 197-203, 2016.

[13] A. Obia, "The effect of industrial air-borne pollutants on the durability of galvanized iron roofs in the tropical humid region of Nigeria," *Global Journal of Environmental Sciences*, vol. 8, issue 2, pp. 89-93, 2010.

[14] A. E. Obia, H. E. Okon, S. A. Ekum, E. E. Eyo-Ita, and E. A. Ekpeni, "The influence of gas flare particulates and rainfall on the corrosion of galvanized steel roofs in the Niger Delta, Nigeria," *Journal of Environmental Protection*, vol. 2, issue 10, pp. 1341-1346, 2011.

[15] A. E. Obia, H. E. Okon, S. A. Ekum, A. E. Onuegbu, and P. O. Ekeng, "The role of sulphur dioxide and gas flare particulates on the corrosion of galvanized iron roof sheets in South-South Region of Nigeria," *Scientific Research and Essays*, vol. 6, issue 27, pp. 5734-5740, 2011.

[16] A. Ogidiolu, "Effects of gas flaring on soil and vegetation characteristics in oil producing region of Niger Delta, Nigeria," *Int. J. Ecol. Environ. Dynamics*, vol. 1, pp. 47-53, 2003.

[17] J. O. Oseji, "Thermal gradient in the vicinity of Kwale/Okpai gas plant, Delta State, Nigeria: Preliminary Observations," *Environmentalist*, vol. 27, issue 2, pp. 311-314, 2011.

[18] Otunkor Oliver Ollisemauche and Ohwovorione Peter Avwerosuoghene, "The effect of gas flaring on agricultural production of Okpai, Ndukwa East Local Government Area, Delta State, Nigeria," *Standard Scientific Research and Essays*, vol. 3, issue 9, pp. 266-272, 2015.

[19] P. A. Scheren, A. C. Ibe, F. J. Janssen, and A. M. Lemmens, "Environmental pollution in the Gulf of Guinea – A regional approach," *Marine Pollution Bulletin*, vol. 44, issue 7, pp. 633-641, 2002.

[20] R. E. Schwartz and J. W. White, "Predict radiation from flares," *Chemical Engineering Progress*, vol. 93, issue 7, pp. 42-49, 1997.