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ASSESSMENT OF ENVIRONMENTAL IMPLICATION OF OIL EXPLORATION IN AKKO LOCAL GOVERNMENT AREA GOMBE STATE, NIGERIA

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ABSTRACT

Harnessing and exploration of natural resources has become critical in stimulating socio-economic and technological development since industrial revolution, although with all its countless benefits, it also has some numerous environmental impacts that trigger global environmental menace. Therefore, the study assessed the environmental implication of oil exploration in Akko Local Government Area, Gombe State, Nigeria. A multi-stage sampling technique was used in selecting 384 respondents. Data was collected using structure questionnaire, key informant interview (KII) and focus group discussion (FGD). The data was analyzed using statistical tool (SPSS Version 20) and Geographic information system software. findings of the study revealed that, the satellite imagery of land use/land cover of the study area indicated clear changes especially places that were covered by vegetation before, are now occupied by buildings and road constructions and that attests and confirmed commencement of extraction of crude oil in the study area as confirmed by 37.5% of the respondents. Additionally, the study revealed that (79.7%) of the respondents were aware of the oil and gas exploration activities impact negatively on the environment. About 52.9%, 49.2% and 39.8% of the respondents perceived an increase in land crisis, worsen environmental pollution, health concerns, loss of livelihood and conflict of interest, may be the order of the day as their negative expectations respectively. Therefore, the study concluded that oil exploration has impacted negatively in the environment and the ecosystem Therefore the study recommends that the federal government and oil exploration companies should ensure effective consultation and partner proactively with host communities to better their operations that may reduce environmental degradation and improve the standard of living of the people in the areas.

Keywords: Environment, Implication, Oil Resources, Exploration

INTRODUCTION

Hydrocarbon is an essential biochemical compound that facilitate the rapid growth and development since the onset of industrial and transportation revolutions, it has proven that the aforementioned eras witnesses an unprecedented economic rejuvenation with the discovery of oil and gas resources in different countries across the globe (Twum, 2019).

Oil and gas exploitation continue to attract massive attention in many countries partly due to the high premium placed on oil revenue mobilization as well as the critical uses that oil and gas could be put to in the aviation and automobile industries, worldwide (Eder et al. 2017; Al-Naser and Al-Habib, 2019). The drive to oil and gas exploitation worldwide is accompanied by various systemic development challenges including the discharge of complex moisture of different organic and inorganic compounds (Purified Water) into the environment (Nasiri et al. 2017); water management challenges associated with unconventional oil and gas exploration (Smith et al. 2017); and poor management of other poisonous substances that impact the health of people in nearby communities (Enyoghasim et al. 2019).

Since 1958, when oil exploration began, many environmental problems have arisen, such as oil pollution of soil and water, degradation of biodiversity and food production and atmospheric pollution from gas flaring all of which have impacted upon the health and well-being of communities living in the region (UNEP, 2016). In Nigeria, oil and gas prospects and explorations are dramatically related with various dimensions of impacts, which could be positive or negative. The impact could be on the environment or on the socioeconomic activities as well as the livelihood of the host communities (Purdy et al. 2019). In the same vein Elum et al.(2016) reiterated that pollution led to the migration of farmers and fishermen who have lost their primary means of livelihoods.

The objectives of the study was to

i. Examine the impact of oil exploration on land use land cover of the study area.
ii. Examine the impact oil exploration on the Environment.

Significance of the Study

The consequences of global warming and other environmental devastations across the globe have led to recessions of lakes and rivers, desertification, loss of soil fertility, landslides and myriads of many ecological problems have become more devastating and frequent (Martinez, 2007). Moreover, the research provided the vivid pictures of both the positive and negative impacts of the exploration projects on the environment and the host communities. The study has also suggested the role of governments, multinationals companies working on the projects and the general public for sustainable oil and gas exploration in the area. This is in view of the dire need to mitigate the negative consequences of the exploration activities in the area. In addition, the study revealed the level of impact and advised policymakers on sustainable oil and gas exploration.

Conceptual Issues and Literature Review

Concept of Environment

Environment is used in this study to refer to the condition, or circumstances under which all living and non-living things occur naturally on Earth (Turner et. al. 2016). This includes: micro-organisms, vegetation, soils., rocks, seas, atmospheric, ecological units and other natural phenomena. Moreover, environment is also refer as the sum total of all conditions that surround man at any point in time on the earth's surface (Indu,

2017). According to Atalawei (2017) anything that affects human existence, be it air, land, water subjacent and adjacent can be term environment.

Concept of Oil Resources

Oil resources here refer to non-renewable resources that take millions of years to be created under the surface of the earth (Dam, 2014). On the other hand oil resources the term generally applied to all quantities of petroleum (recoverable and unrecoverable) naturally occurring on or within the Earth Crust, discovered and undiscovered plus those quantities already produced (Harraz, 2016).

Concept of Environmental Degradation

Environmental degradation is the deterioration of the environment through depletion of resources, (air, sea/ water, and soil, the destruction of ecosystems and the extinction of wildlife, Stern et al. (2017). It also involves any change or disturbances to the environment perceived to be undesirable by the host communities and detrimental to their socio-economic activities (Turner et. al. 2016).

Study Area and Methodology

The study area is located on latitude 9°30′ -10º30′ N and longitude 10°40' -11°30′ E. The LGA has an area of 1,272 km² (C-GIDD, 2021). It is bounded to the North by Kwami and Dukku as well as Gombe Local Government Area, to the East by Yamaltu Deba L.G. A. and to the south by Billiri and and also to the west by Alkaleri L.G.A of Bauchi State, Nigeria. The area is located on complex geologic crystalline bedrocks. Although the ancient crystalline basement complex sedimentary underlies much of the area formed during the late craterous period which influence the topography of the area (Mayomi, et al. 2018).

Akko local government area has two distinct seasons in a year that is wet and dry seasons with a mean annual rainfall of 850mm. The mean maximum monthly temperature is 37°C occurring in March and April, while the mean minimum monthly temperature is 19°C during the month of December and January, while the mean annual temperature of Akko LGA is around 27°C (Jibo et al. 2020). The soil of Akko Local Government Area is that of tropical ferruginous type. They are brownish reddish in color and have a pH value ranging from 4-6 depending on the location. The predominant tree species in the study area are Acacia *Africana/Isoblina*, Dumb palms, *Parkia biglobosa*, *Alexia Africana*, Butyrospermum, paradoxum, Tamarindus indica, Aflexia Africana and Azikdiracta indica thus vegetation cover influences several aspects of the environment.

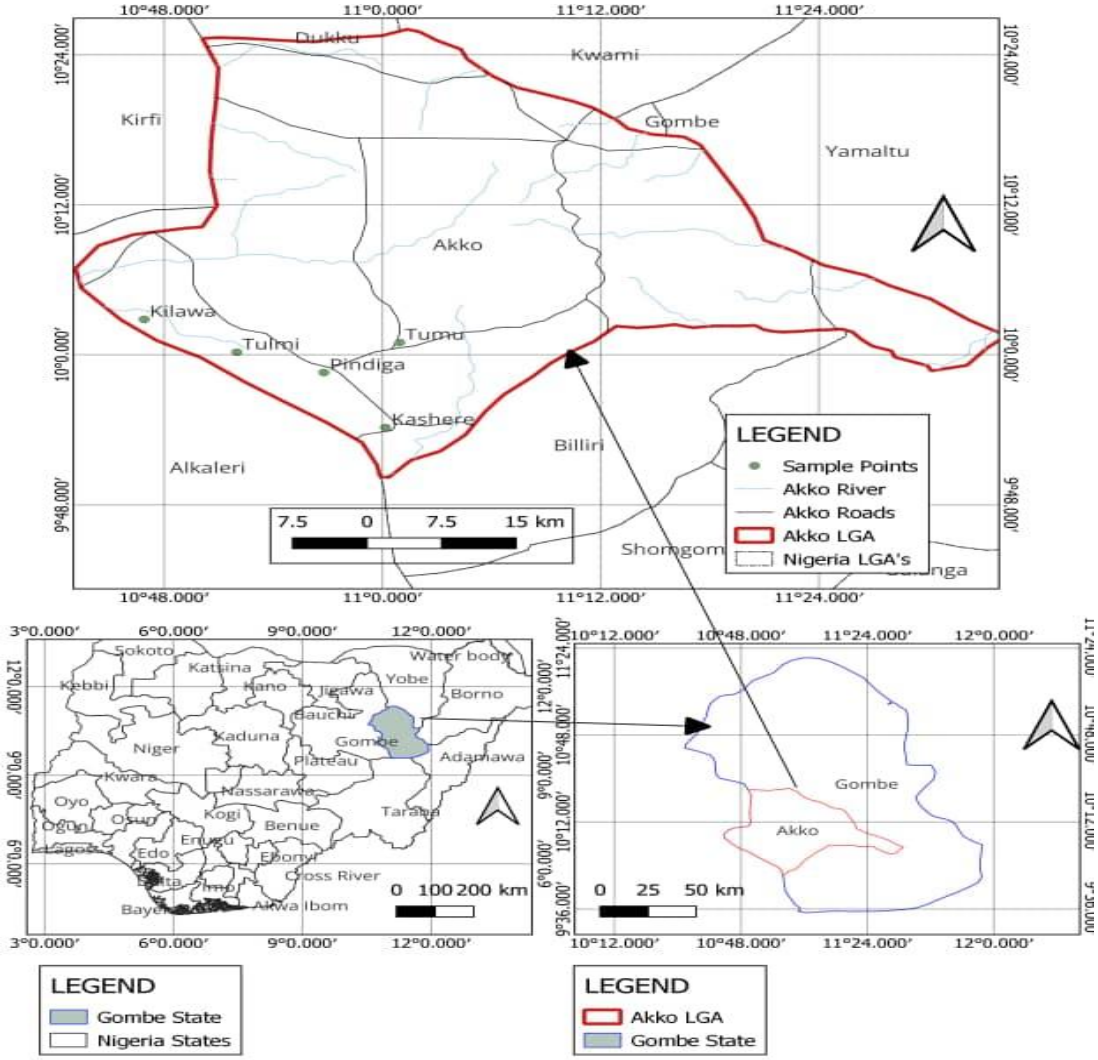

Figure 1: Study Area
Source: Adapted and Modified from Administrative Map of Gombe State (2022)

Sample Size and Sampling Technique

In selecting the political wards for the study purposive sampling technique was used in choosing the wards that falls within the study area. While administering questionnaire systematic random sampling technique was used during survey.

Population projection was done using Newsman's formula (2001)

$$\mathbf{pn = p0 + (\frac{1+R}{100} \times P0)n}$$

Where P_n=population in the recent year

P_0=population in the base year

R= annual growth rate

n=number of intermediate years

The population projection was made because the study requires population of each political ward which was not available in the official document of National Population Commission based on the national population census 2006, therefore the study used the aforementioned formula to obtain the projected population of political ward. Consequently, the total projected population of the study area was 327529 for the year 2022 thus from aforementioned figure the sample size of study area was obtained by applying Yamane (1967) formula for sample size calculation.

Table 1: Political Wards in Akko L. G. A. Gombe State

S/N	Wards in Akko L. G. A	2018 Projected population	2022 Projected population
1	Akko	30701	38356
2	Garko*	117164	146394
3	Kalshingi	32728	40893
4	Kashare*	44349	55414
5	Kumo central	60789	75954
6	Kumo east	54658	68293
7	Kumo north	16881	21091
8	Kumo west	64729	80874
9	Pindiga*	26457	33057
10	Tukulma*	29714	37124
11	Tumu*	44450	55540
	Total	522620	652990

Source: Field survey, 2022

Table 1 presents the projected populatin of each political ward in Akko local government area of Gombe State, in order to be able to obtain the population for the study, the researcher had to identify the specific wards that are fully affected by the oil and gas exploration project.

Sample size for the study was determined using Yamane (1967) formula; the formula is given as follows;

$$\boldsymbol{n = \frac{N}{1 + N(e)2}}$$

Where n=sample size

N=population Size

e=margin of error

Table 2: Wards that Comprises the Study Area

S/N	Wards	2018 Projected population	2022 Projected population
1	Garko	117164	146394
2	Kashare	44349	55414
3	Pindiga	26457	33057
4	Tukulma	29714	37124
5	Tumu	44450	55540
	Total	262,134	327,529

Source: field survey, 2022

The sample size was derived from the summation of the projected population of 2022 in table 2 through applying the Yamane formula and the figure obtained was 400, therefore, the copies of questionnaire administered was 400.

RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents covered in the study include: age, sex, education, marital status, occupation, land ownership, and income.

Age of the Respondents

Age to a large extent determines the productivity of workers, result of socio-economic characteristics in table 3 shows that 30.2% of the respondents were between the age brackets of 1-28 years, 27.6% were within 40-49 years and 27.6% falls within the age range of 29-39 years. This indicates that respondents were in their active age in the study area. This implies that respondents in the study area were both men and women which are capable of participating in the activities of the oil and gas exploration.

Table 3: Distribution of the Respondents Based on Age

Age	Frequency	Percentage
18-28	116	30.2
29-39	89	23.2
40-49	106	27.6
50-59	59	15.4

Age	Frequency	Percentage
60-69	14	3.6
Total	**384**	**100.0**

Source: Field Survey, 2022

Sex of the Respondents

Figure 2 reveals that (81.0%) of the respondents were male while 19.0% were female. This indicates that male were the dormant respondents during the survey in the study area than their female counterpart. This implies that more men were contacted than women during the survey that may be due to the religion and cultural practices of the area where women are restricted from unnecessary movement and interaction with unrelated members of the society.

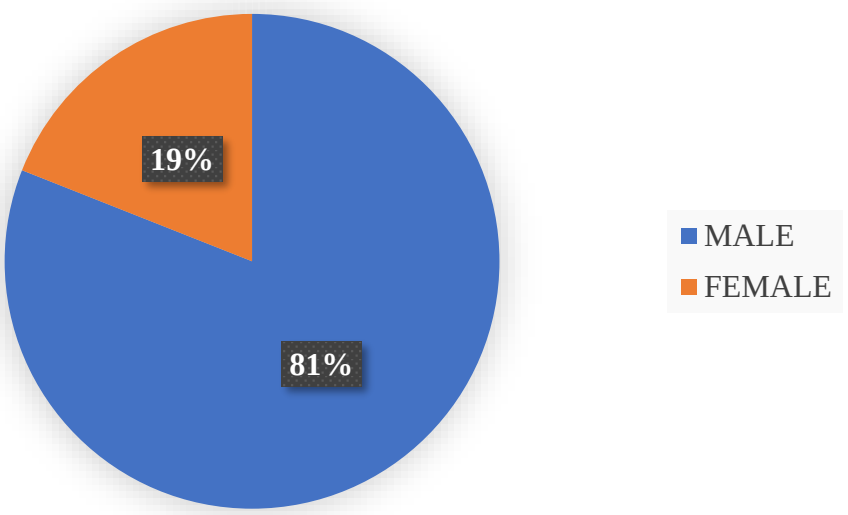

Figure 2: Sex of the Respondents
Source**:** Field Survey, 2022

Educational Levels of the Respondents

Figure 3 further indicates that, 29.2% and 21.6% of the respondents attended secondary and tertiary school while 12.8% and 2.6% of them have primary education and adult education respectively. About 24.0% of the respondents have Qur'anic education and 9.9% have no education. This indicates that, the respondents in the study area were literate with at least one or two persons have attained a formal education system either from primary to tertiary education.

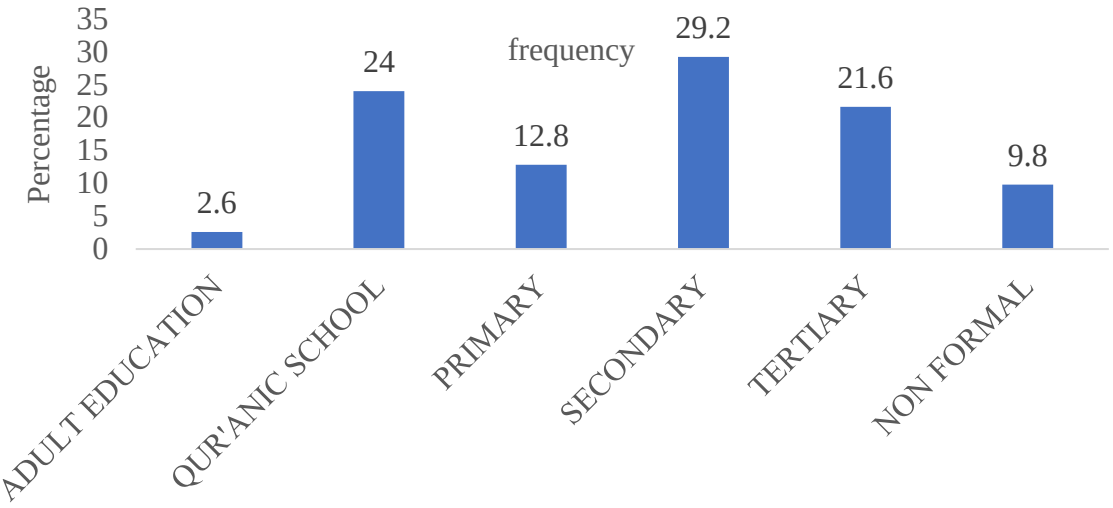

Figure 3: Educational Levels of the Respondents
Source: Field Survey, 2022

Figure 3 further indicates that, 29.2% and 21.6% of the respondents attended secondary and tertiary school while 12.8% and 2.6% of them have primary education and adult education respectively. About 24.0% of the respondents have

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Pattern of Land use Land Cover Change

The Land use land cover of the study area focused on the following physical features build area, vegetation, water body's bare lands and rocks were determined (figure 4). The research findings shows that, vegetation as at of 2018 is having (52.3%) while at 2020 the vegetation has reduced to (45.6%) and (44.5%) at 2022 (Table 4.6 and figure 4.3), this may be attributed to increase in the buildup area where at 2018 (25.6%), at 2020 the buildup area size is (29.2%) and increased to (31%) in 2022 (Table 4.6 and figure 4.3) this may be as the result of high increase in population of the study area. This finding is inconformity of Nura, (2022) in a research land use land cover change of Yamaltu Deba Local Government Area., Gombe State. The result further shows that, water body size of the study area are decreasing where the total size at of 2018 is (0.1%), at 2020 the water body shrink to (0.06%) and at 2022 to (0.4%) (Table 4 and figure 4) respectively, This finding may be as the result of climate change and based on the finding the bare lands size are increasing in 2017 (29.9%) while at 2020 bare land increased to (25.1%) and to (25%) in 2022 (Table 4 and figure 4), there are no change in bare lands between 2020 to 2022 this may be as the result of the slightly change in vegetation land size between 2020 to 2022 (Table 4 and figure 4), this finding contradicts that of Ahmed, (2018).

Table 4: Land use Land Cover Change of the Study Area

LULC Types	2018 Area km^2	Area in Percent (%)	2020 Area km^2	Area in Percent (%)	2022 Area km^2	Area in Percent (%)
Water body	0.0353	0.1	0.0201	0.06	0.0141	0.04
Vegetation	18.457	52.3	16.096	45.6	15.999	44.5
Build area	9.038	25.6	10.301	29.2	11.004	31
Rocks	0.0011	0.03	0.0012	0.003	0.0011	0.003
Bare land	7.732	21.9	8.845	25.1	8.945	25
	35.2634	100	35.2634	100	35.2634	100

Source: Field Survey, 2022

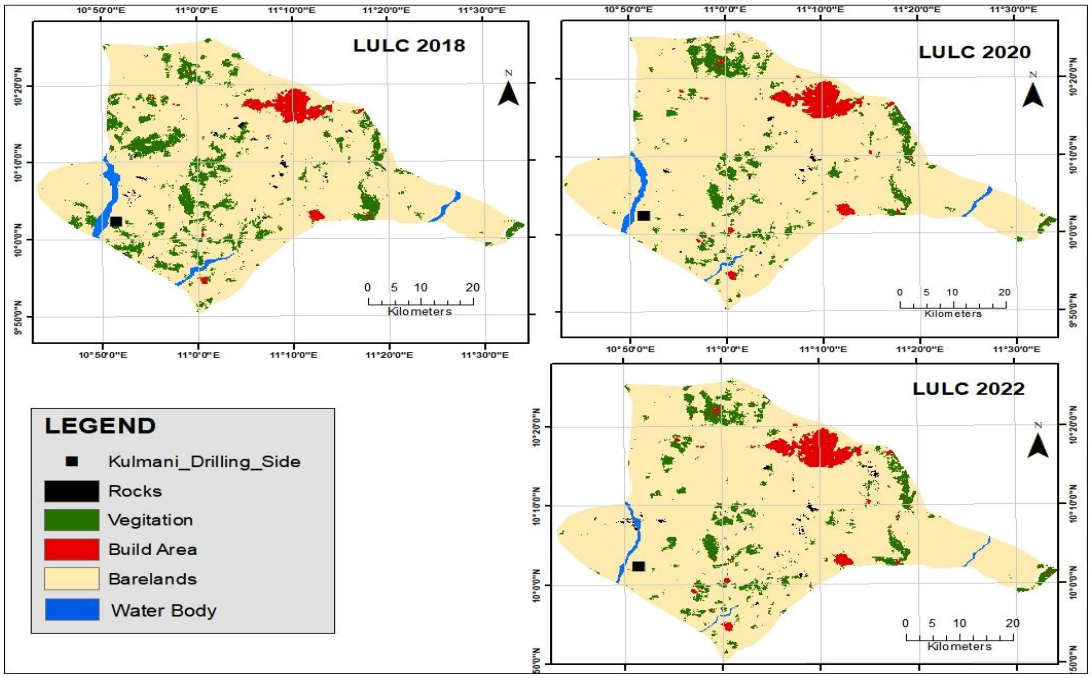

Figure 4: Land use Land Cover of 2018-2022, Akko L.G.A
Source: Global Land Cover Facilities

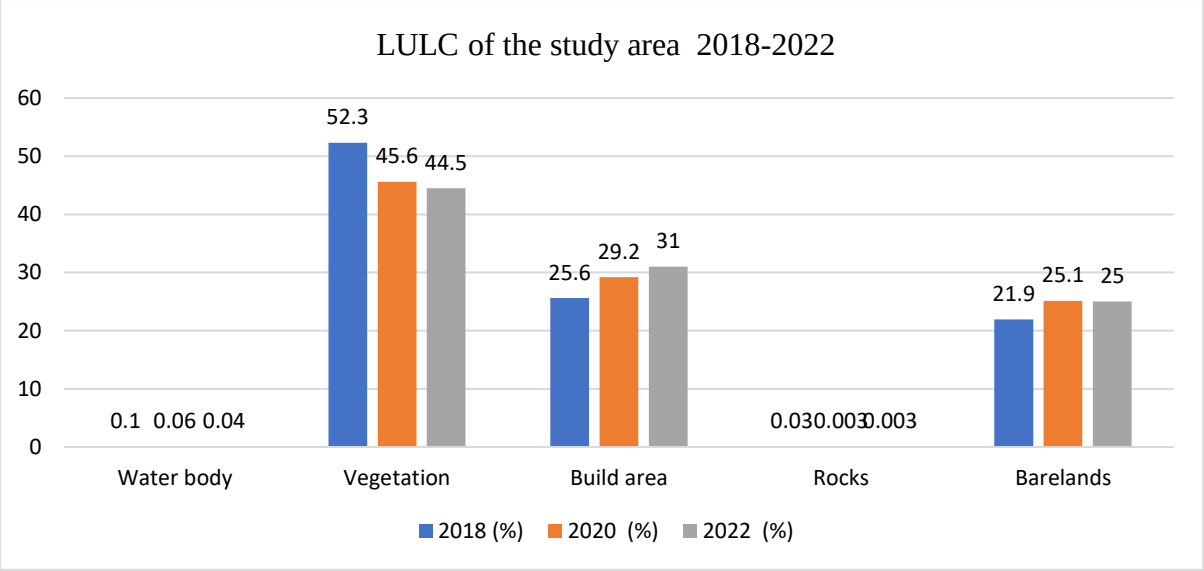

Figure 4: Bar Graph LULC of the Study Area
Source: Field Survey, 2022

Land use Land Cover in Relation to Kolmani Drilling Site

On the other hand, water body and rocks shows less significant land use change. Other types of land use decreases as the buildup land increases. The result also indicated that, there is indication of increase in land use building around the Kolmani mining site because the result shows some settlement around river at the southern part of the study area, and its observed that, its most likely the communities closer to the side using river Kolmani for their domestic purposes can be affected by the mining activities, the finding of the study is in harmony with the work of Idris, (2017) in a research work land used land cover on industries liquid waste in Sharada Kano Sate.

Type of Crude Oil Production Activities

Table 5 revealed the perceived activities that are readily available in the oil drilling field, extraction of crude oil was about to commence in the study area as revealed by 37.5% of the respondents. Geologic survey was also in progress as revealed by 34.6% of the respondents. Thus, other oil and gas production activities exist in the study area were crude oil prospecting, land acquisition and gas flaring as indicated by 19.5%, 7.8% and 0.5% of the respondents respectively. This implies that the oil and gas production activities is visible and is still progress in the study area.

Table 5: Distribution of Respondents Based on the Activities Available on the Oil Field

Activities	Frequency	Percentage
Crude oil Prospecting	75	19.5
Crude oil extracting	144	37.5
Geologic Survey	133	34.6
Land Acquisition	30	7.8
Gas Flaring	2	.5
Total	**384**	**100.0**

Source: Field Survey, 2022

Awareness of Environmental Impact

Figure 5 revealed that, 80% of the respondents are aware of the oil and gas exploration activities' impacts on the environment and 20% were not aware of any impacts. The high level of awareness on the impacts of the oil and gas on the environment could be due to the high literacy of the respondents in regards to their educational level which gave them ability to research on their own about the effects of the oil and gas exploration activities and understand the negative implication of the exploration on human health and the ecosystem entirely, as demonstrated by Amannet et al., (2017) reiterated that controlling emission during oil and gas exploration would substantially reduce premature deaths caused by air pollution. Moreover, Abdullahi et al. reiterated the significance of environmental education, campaign and environmental awareness towards averting environmental degradation and pollution control.

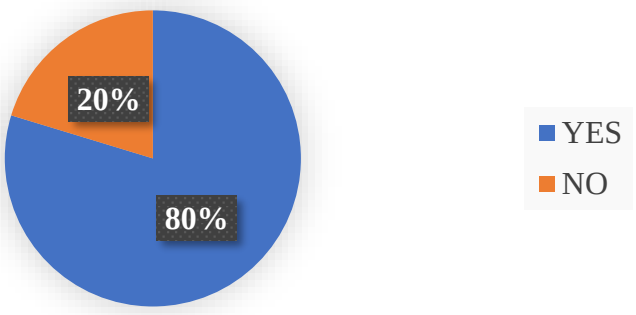

Figure 5: Awareness of Environmental Impact of the Respondents
Source: Field Survey, 2022

CONCLUSION

Therefore, the study concluded that oil exploration has impacted negatively on the environment and the ecosystem which have significantly caused environmental degradation, soil erosion, deforestation, loss of farmlands as well as impact on the biodiversity richness through distorting the ecosystem and unbalancing the biodiversity richness of the environment, pollution (Air, Water, and land), death of species, vegetation loss, health effects, terrestrial impacts and insecurity. Moreover, the aforementioned environmental menace requires prompt approach in order to ameliorate and mitigates the drastic effects on the environment as well as the host communities.

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