

**IMPACTS OF OIL EXPLORATION AND PRODUCTION ON PASTORALISM AT  
BALILA AREA, WEST KORDOFAN STATE, SUDAN**

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**ABSTRACT**

This study was conducted at Balila area, West Kordofan State, Sudan in September 2018. The aim of this study was to examine the impacts of oil exploration and production operation on pastoralism at Balila area. Three communities being, Balila, Elshag and Elfrdus were selected for the study. The study employed both primary and secondary sources for data collection. Primary data involved administration of structured questionnaire to 139 inhabitants using simple random sampling. Three focus groups discussions were carried out in each of the three sites. Descriptive statistics were used to analyze the data using SPSS software program (version 22). Data were presented on the basis of frequencies and percentages. Results indicated low human capital development with the majority of respondents (97.2%) being illustrate or with basic education. Results revealed that majority of the interviewed inhabitants confirmed adverse effects of oil exploration and production activities on the environment and consequently on their livelihoods. Perception of respondents towards these negative impacts confirmed: decline of soil fertility (82.7%);shrinkage of rangeland (79.1%); dropping in crops yields(70.5%); deforestation(89.9%); contamination of both surface and groundwater(61.9%) and increase in morbidity(99.3%) and mortality(87.8%) among livestock. Further, community individuals agreed that they are vulnerable to health hazards such as cancer, kidney failure, skin irritation, and miscarriage and fertility problems.

**Keywords:** Pastoralism, oil, exploration, WestKordofan.

**1. INTRODUCTION**

Pastoralism occurs in more than 100 countries on about 25 % of Earth's land area and supports about 200 million households and herds of nearly a billion animals, including camels, cattle, and smaller livestock that account for about 10 % of the world's meat production (FAO, 2001).It can be interpreted that nomadism or the movement of stock according to season is a form of grazing management system which is still being carried out in many settled communities such as the Turkaman of the old Soviet Union, and among most of the Middle East countries. The only difference from Sudan and may be the Sudanese Sahelian countries is the fact that in these

countries, these seasonal movements are controlled and the grazing utilization is conditioned by the availability, the condition, and the readiness of grazing for livestock use. Pastoralism provides very important ecological services, such as primary production, biodiversity conservation, and erosion control (FAO, 2019). Pastoral nomads depend on range lands and move with stock to where feed and water are available but within specific geographical zones. In Kordofan, Darfor, Central and Eastern regions this system is considered as the main live stock production for meat for real demand and for export.

The rise of oil production in Western Kordofan State has disrupted pastoral livelihoods in oil producing areas and diminished the importance of livestock production for the Sudanese economic (Leonard, 2007).

There is no doubt that the exploitation of oil has many benefits to the national economy, but we cannot lose sight of the effects it has on the environment and change the components of the natural resources of the area as well as its social and economic impacts. Some changes in the soil appeared with a clear decrease in the number and quality of plants and that corresponds to (Wyszkowski and Ziolkowska, 2008). The flow of oil over large areas of rangeland has had the effect of reducing and changing.

The above features are very much influenced by anthropogenic factors, which include the contamination of soil with petroleum-derived products. Changes in some soil properties resulting from contamination with petroleum-derived substances, and particularly those related to physico-chemical composition, brings about some changes in the biological composition of soil which, in consequence, can lead to water and oxygen deficits, as well as to a shortage of available forms of nitrogen and phosphorus (Wyszkowska and Kucharski, 2000).

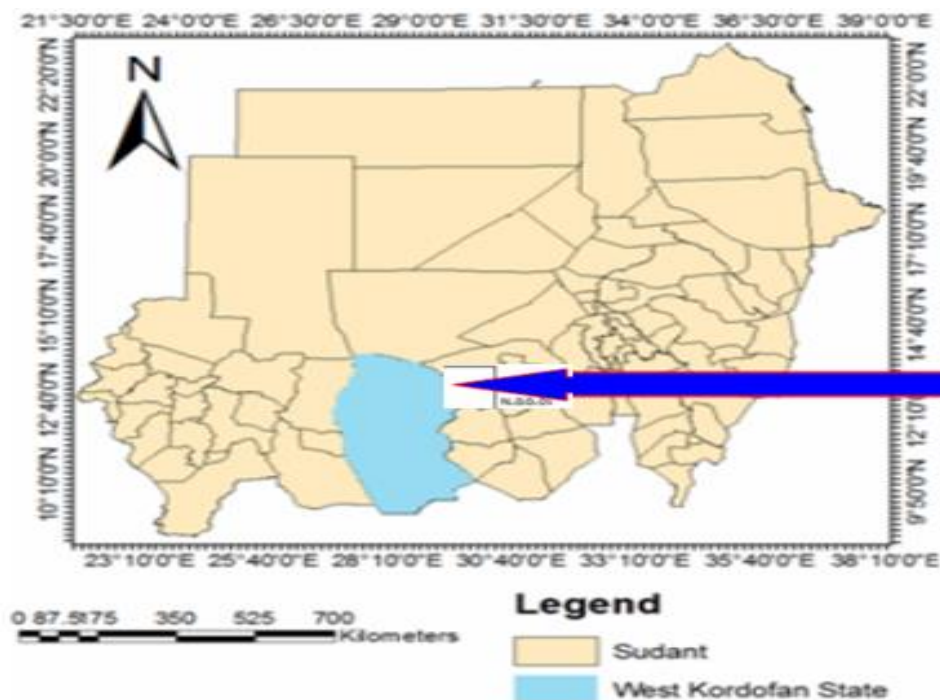
Soil constitutes the living environment not only for people, but also for plants and animals and through its functions provides for the needs of the natural environment (Kuch and Bavumiragira, 2019). The contamination of the natural environment by petroleum substances contributes to the degradation of land, and the occurrence of many spot and area sources of contamination overtime results in the creation of various integrated underground environments contaminated with these substances (Sztompka, 1999). Particularly dangerous soil contaminations include pollution with petroleum, which is very often observed in municipal soils, around industrial plants and in areas where petroleum and natural gas are obtained (Adam et al., 2002; Clark, 2003).

## **2. MATERIALS AND METHODS**

### **The study area**

Balila area is located at West Kordofan State in the central part of Sudan extending from 11.250 N to 16.670 N latitudes and from 27.500 E to 32.420 E longitudes. The State covers an area of approximately 114,000 Km<sup>2</sup> (Guuma, 2017). The area is a forested land scattered with some plains, valleys and sand dunes which is considered as one of the poor savanna belts. The two main livelihood systems have traditionally been pastoralism and subsistence farming. Pastoralist

communities in the area include both nomadic and semi-nomadic (transhumant) cattle, sheep and goat herders.



### Data collection

Data collection made use of both primary and secondary sources. Primary data relied on administration of 139 copies of structured questionnaire to inhabitants using simple random sampling, and on groups discussions with local leaders and relevant people in the target population..Three communities, Balila, Elshag and Elfrdus villages were selected for the study. Secondary data were obtained from relevant sources.

### Data analysis

Descriptive statistics were used to analyse the collected data using SPSS software program (version 22). Data were presented on the basis of frequencies and percentages..

## 3. RESULTS AND DISCUSSION

The majority (36.7%) of the respondents were between the ages of (30-45) years, while (25.9%) were (45-55) years of age. The number of males sampled was higher (64%) as men are more willing to participate than women (Table 1).Result also indicated low human capital development in Balila area because the majority of the respondent (74.9%)had no regular education. This high rate of illiteracy may be attributed to unavailability of schools and lack of interest of many families to educate their sons. According to table 1 herding constitutes the main

occupation for almost 70.5% of the respondents whereas agro-pastoralists constituted about 23.0%. New jobs have appeared in the area such as casual labors working in the oil company and petty trade. Livestock selling constitute the main source of income (79.9%). In order to increase their purchasing power some herders liquidate some of their livestock resulting in reduce of herd number. Further, 14.4% of respondents agreed that selling agricultural crops such as watermelon and okra have greatly contributed to households' subsistence.

Table 2 shows the perception of respondents towards change in soil and plant due oil exploration and production. About 82.7% of respondents confirmed that their soil has been degraded. About 79.1% of respondents confirmed decrease in grassland production, whereas 70.5% agreed that there was reduction in crop production in farmlands. Pollution of grasslands and farms is a well-known phenomenon (Ekekwe, 1981). The flow of oil over large areas of rangeland has had the effect of reducing and changing its flora (Wyszkowski and Ziolkowska, 2008).

The obtained results could be explained by the fact that oil reduces the soil fertility such that most of the essential nutrients are no longer available for plant and crop production. Oil spills has adverse effects on nutrient level and fertility status of the soil (Abii and Nwosu, 2009). Abosede, 2013 reported that oil pollution might affect soil physical properties. Pore space might be blocked which could reduce soil aeration and water infiltration and subsequently affect plant growth. Oil exploration and development at Balila area adversely affected the pastoral communities' livelihood by reducing the availability of pastures and hereby resulting in reduction in herds' number and increase of morbidity and mortality of livestock.

The adverse effects of oil activities on the environment arise from oil leakages, gas flaring and the escape of other chemicals used in the process. According to groups discussions local inhabitants have noticed the presence of chemical and chemical containers buried in the soil. Oil spills render the soil toxic and unproductive. Spilled oil which is denser than water, reduces and restricts permeability: organic hydrocarbons which fill the soil pores expel water and air, thus depriving the plant roots the much-needed water and air (Brain, 1977). Adam et al., 2002; and Clark, 2003 confirmed the adverse effects of oil on soil characteristic and vegetation cover. Accordingly, a necessity arise for the adoption of remediation technique to restore contaminated soil. The company (Petro energy) involved in oil production at Balila area treat the contaminated soil with cow droppings to break down pollutants. Kelechi, et al. 2008, reported that the addition of cow dung to oil contaminated soil make such contaminated soils useful for agricultural activities and improve growth performance of the plants.

Destruction and disappearance of some forest tree species was observed by majority of respondents (89.9%). noticed some changes in forests trees of the area. 23.2% of respondents confirmed disappearance of certain tree species such as Albizia amara, whereas 72.8% confirmed absence of natural regeneration. Forest destruction results from illegal tree cutting

Percentages distribution of respondents according to the impact of oil exploration and production on water resources in Balila area was given in Table 3. A total of 89.2% of respondents agreed that wells and hafirs are the main water sources for humans and animals in Balila area. Moreover, about 79.9% of respondents noticed an increase in the number of water points since the beginning of the oil activities in the area. Water availability might be considered as a positive

contribution of oil activities to local communities. The oil company drilled more than 80 water wells in the area (Petro- Energy Company 2016). Moreover, the construction points dug by the company to obtain earth for road network construction served as additional water points.

Pastoralists believe that the oil industry has contaminated water supplies and pastures, and say that their cattle are suffering as a result, especially as regards fertility (Pantuliano et. al., 2009). Table 3 showed also, that about 47.5% of respondents confirmed change in the quality of the water. Further, 86.1% of respondents confirmed contamination of both surface and underground water as a result of oil activities. When oil spills occur it seeps into the ground and becomes mixed in the underground water system. It has been found that polluted underground water nodoubt takes many years before it can be remedied. Yet this underground water moves into streams and wells which are the only sources of local water supply in the community which results in the rise of water-borne diseases ((Kuch and Bavumiragira, 2019)

The drilling process is known for contaminating drinking water sources with chemicals that lead to some types of diseases such as cancer, birth defects and liver damage. During drilling operations, the seepage of effluent water to the surrounding areas is a major source of pollution. Oil activities in pastoral areas altered the natural drainage system due to road construction against the normal cantor. This on one hand lead to drying up of some seasonal water bodies and on the other hand accumulation of watermelon roadsides caused death of trees and reduced cultivable land. Hence, rangeland farmland, forests and wildlife habitat were miserably affected (khaleel and Ahmed, 2014).

The perception of respondents towards the effects of oil industry activity on public health in Balila area was given in Table 4. About 86.4% of respondents confirmed appearance of some diseases as a result of oil activities and a total of 94.2% noticed increase in the number of patients while 89.9% of respondents confirmed increase in death rate in the community. Further, 97.1% of respondents confirmed appearance of unfamiliar diseases such as cancer, kidney failure, and skin irritation diseases. Chemicals used and derived wastes in oil exploration and production operations proved to be highly harmful to human health (Maria, et al. 2017). Local inhabitants who live around Balila oil fields relate the emergence of such strange diseases and other serious conditions in themselves and their children to the activities of the oil industry. People who reside near oil exploration activities may be exposed to toxins from gas flares or oil spill and hence increasing the risk of developing certain types of cancer (Pauline, et. al. 2019). Similarly, Atubi, 2015, reported that in Nigeria, people living around oil fields agreed that they were vulnerable to health hazards. 92.1% of respondents noticed the presence of fertility problems since the arrival of the oil industry in the area. Atubi, 2015 who worked in Delta State in Nigeria reported that because of oil operations the release of toxic materials and disposal of industrial wastes may affect the fertility of the inhabitants in such away the fecundity fall and the birth of abnormal babies may increase.

Rubbish pits dug by the operating company for disposing domestic and industrial wastes, such as empty chemical containers, are not properly managed. During rains these oil- derived wastes seep into the ground and become mixed with underground water or they are washed by runoffs into other water points leading to contamination of water resources. Some of the empty

chemical-containers escape from the industry into the villages where they are used for storing drinking water. These containers could be a major source of water pollution.

Table 5 shows the impacts of oil activities in Balila area on animals. The majority of respondents agreed that there is decrease in livestock number, increase of diseases and increase in mortality rate among livestock (88.5%, 99.3% and 87.8% respectively) locals are convinced that oil activities have adversely affected rangeland, and that most livestock losses experienced in the last few years are due to water contamination and poor waste disposal. Polluted water is said to have become a threat to animal health with livestock numbers decreasing steadily since drilling began (Pantuliano et. al., 2009). Never the less.

#### **4. CONCLUSIONS**

The study has revealed that activities associated with oil exploration and production operation in Balila area have local significant impacts on the environment and subsequently on the livelihoods of the communities. Most of the respondents confirmed increase of soil infertility, reduce in available pastures and farmlands resulting in reduction of both herds' numbers and crop production. Contamination of surface and ground water due to oil activities have increased morbidity and mortality rates among livestock. Because of Air pollution and contaminated domestic water communities around Balila oil field are vulnerable to health hazards. The emergence of strange diseases such as cancer, kidney failure, miscarriage, skin irritation and fertility problem was observed.

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**Table: 1 Personal characteristics of respondents**

Personal characteristics	Frequency	Percentage% (n= 139)
Age		
25-35	22	15.8
35-45	51	36.7
45-55	36	25.9
More than 55	30	21.6
sex		
Male	89	64
Female	50	36
Education		
Illiterate	104	74.9
Primary/Basic	31	22.3
Secondary	4	2.8
Occupation		
Herder	98	70.5
Agro-pastoralist	32	23.0
Casual labor	6	4.3
Trade	3	2.2
Sources of income		
Livestock sales	111	79.9
Crop sales	20	14.4
Petty trade	8	5.7



**Table: 2 Impact of oil activities on soil and plant in Balila area.**

Criteria	Frequency (n=139)	Percentage (%)
Soil contamination	115	82.7
Yes	24	17.3
No		
Grassland production		
decreased	110	79.1
increased	112	8.6
No change	17	12.3
Causes of grassland decline		
Oil activities	97	69.8
Reduce of rangeland area	32	23
Low rainfall	10	7.2
Farmland production		
decreased	98	70.5
increased	41	29.5
Forest tree cover		
changed	125	89.9
No change	14	10.1
Causes of change		
Destruction of tree species	48	34.5
Absence of natural regeneration	91	65.5
Purposes for tree cutting		
charcoal	52	37.4
Road construction	38	27.4

building	31	22.3
Oil pipe route	18	12.9

**Table: 3 impact of oil activities on water sources in Balila area**

Criteria	Frequency (n=139)	Percentage (%)
Water sources		
Hafir	9	6.5
Wells	77	55.4
Rahad	3	2.2
Hafir and wells	38	27.3
Hafir, wells and Rahad	12	8.6
Water points:		
Increased	111	79.9
Decreased	15	10.8
No change	13	9.4
Water quality		
Changed	73	52.5
No change	66	47.5
Causes of water contamination		
Oil industry wastes	86	61.9
Oil spill	22	15.8
Use of the industry containers	31	22.3

**Table: 4 impact of oil exploration and development on human health in Balila area**

Criteria	Frequency (n=139)	Percentage (%)
human diseases		
Increased	131	94.2
No change	8	5.8
Appearance of new diseases		
Yes	135	97.1
No	4	2.9
New diseases		
Cancer	42	31.1
Kidney failure	36	25.9
Skin irritation	34	24.5
Miscarriage	27	19.5
Appearance of fertility problems		
Yes	128	92.1
No	11	7.9
Human death rate		
Increased	125	89.9
No change	14	10.1

**Table: 5 Impacts of oil activities on animal in Balila area**

criteria	Frequency (n=139)	Percentage (%)
livestock numbers		
declined	123	88.5
increased	16	11.5

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Increase in livestock disease		
Yes	138	99.3
No	1	0.7
Mortality rate among livestock		
Increased	122	87.8
Decreased	17	12.2
Causes of morbidity and mortality		
Contaminated water	27	21.8
Oli derived wastes	8	6.5
Unknown	89	71.8
wildlife		
Decreased	129	92.8
Increased	10	7.2