Sub-Sahara African Academic Research Publications
September, 2021 Editions

JASD
Journal of African Sustainable Development
Vol.21, No.2, ISSN: 2115-4255

ENVIRONMENTAL IMPACT OF MINING IN SOME SELECTED COMMUNITIES IN YOBE, YOBE STATE

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ABSTRACT
This study examined the nature of mining operations, the extent of environmental degradation caused by mining activities and effect of mining on other human activities. Data was sourced using observations, focus group discussion and direct measurements of the diameter and depth of pits from the mining locations in Local Government Area. The data was analyzed using descriptive statistics which shows an overburden of dumps which are the basic indicators of degradation at all the mine sites. Soil erosion and land subsidence are observed. Mining activities have also encroached upon other land use activities such as crop cultivation, grazing and forestry. Mitigation can be through increased level of awareness, provision of tarred road to stop encroachment on agricultural land, enforcement of existing regulations, Environmental Impact Assessment etc.

Introduction
Mining activities contribute significantly to the wellbeing of citizens by providing employment and income, it may in some cases, contribute to increased poverty (Ross 2001). This is because of the low levels of employment in the sector, use of mostly imported technology, high market volatility of minerals, competition with agricultural sectors, and institutional corruption and mismanagement (Sideri, 2004).
In some cases, mining has provided jobs in an otherwise economically marginal area (Redwood, 1998). However, typically these jobs are limited in number and

duration. In addition, communities that come to depend on mining to sustain their economies are especially vulnerable to negative environmental and social impacts, especially when the mine closes. Mining tends to raise wage levels, leading to displacement of some community residents, farming activities and existing businesses, and elevated expectations (Kuyek and Coumans, 2003). Mining may also trigger indirect negative social impacts, such as alcoholism, prostitution, and sexually transmitted diseases (Miranda, Hanendex and Yerena, 1998).

Developing countries often seek to exploit mineral resources as a way of providing much needed revenue. Mineral wealth is part of a nation's natural capital and the more capital a nation possesses the richer it becomes (Davis and Tilton, 2003). Papua New Guinea receives almost two thirds of its export earnings from mineral deposits, diamond mining accounts for approximately one third of Botswana's GDP and three quarters of its export earnings (Govt. of Papua New Guinea, 2002).

Mining activities provide employment opportunities to both skilled and unskilled lab our as such citizens living in a community take part in it because of the huge amount of income accruing from it.

By nature, mining involves the production of large quantities of waster, in some cases contributing significantly to a nation's total waste output. Disposing of such large quantities of waster poses tremendous challenges for the mining industry and may significantly impact the environment. The impact are often more pronounced for open-pit mines than for underground mines, which tend to produce less waste. Degradation of aquatic ecosystems and receiving water bodies, often involving substantial reductions in water quality, can be among the most severe potential impacts of mining (Matthews, 2000).

Aim

The Aim of the study is to examine the environmental impact of gypsum mining on selected communities of Fika Local Government Area of Yobe State.

Objectives

The study intends to achieve the following specific objectives:

1. Examine the nature of mining operations in the study area.

2. Assess the extent of environmental degradation caused by mining activities in the study area.
3. Assess the effect of mining on other human activities in the study area.
4. Make recommendations.

Significance of the study

The importance of mineral resources generally in the socio economic and physical development of any particular area is not debatable. However where control and monitoring are not adequately exercised, the extraction of these nature endowed resources has devastating effects on the environments. As a result, a lot of studies have been conducted in areas where mining has significantly affected the landscape in Nigeria. These include Jos Plateau Tin mines, the Enugu coal mines and Delta oil field.

In Yobe State, since the discovery of easily accessible deposits of gypsum, couple with an increasing demand for cement, the exploitation of the mineral has become widespread. This intensified with the ban on the importation of gypsum on the 1st of October 1995. Despite the related problem of landscape disturbance due to mining and obvious threat of further environmental degradation looms ahead.

Literature Review

Gypsum is a naturally occurring mineral that is made up of calcium sulfate and water (CaSO4+2H2O) that is sometimes called hydrous calcium sulfate.

By weight, it is 79% calcium sulfate and 21% water. Gypsum has 23% calcium and 18% sulfur and its solubility is 150 times that of limestone, hence it is a natural source of plant nutrients. Gypsum naturally occurs as sedimentary deposits from ancient sea beds (summer, 1989).

The Environment and Mining

"The environment is integrated and its components are linked by dynamic processes. We cannot use or affect any part without affecting some other part" (Sideri, 2004). He observed that the extraction of minerals in Nigeria, especially by the open cast process has left injurious effects on the land surface. The most widespread destruction of the rural landscape according to him caused indiscriminate quarrying of sand and laterite as well as gravel for road construction and for building purposes.

Mining operations have been envisaged by environmentalist and conservationist alike as causing some of the most devastating and far reaching consequence to the Environment. He also observes that the process of mining fossil fuel and minerals defaces the land with great scars and pits, destroys ecosystems and bring on many undesirable side effects such as water, pollution and the disturbance of hydrolic systems. In addition, he also noted that apart from causing land shortage for farming in the area and a decline in soil fertility due to over cultivation of the remaining land, mining has tended to increase the susceptibility of the soil to erosion. It has increased the occurrences of landslides, mudflows and slumps. (ripley,1996). The removal of soil regolith and bedrock to extract minerals destroys entirely the preexisting ecosystems and habitats of plants and animals (Fryear, 1989). The waste minerals also create problems of pollution of air, water and soil. In underground operations, mining has unfavorable side effects on ground water resources.

In addition to waste management issues, mines also pose environmental and social challenges due to potential disruptions to ecosystems and local communities. Mining requires access to land and natural resources such as water, which may compete with other land uses (Ashton, Mahachi and Dirks, 2001). Although the size of most mining operations is small compared to other land uses (e.g., industrial, agriculture and forestry), mining companies are limited by the location of economically viable reserves, some of which may overlap with sensitive ecosystems or traditional indigenous community lands. Often the larger-scale impacts from mining occur from indirect effects such as road, buildings. An area of approximately 400-2,400 hectares has been colonized in the Amazon Basin for every kilometer of oil pipeline built (Ledec, 1990). In the Philippines, upland ecosystems are under pressure as a result of the migration of small-scale farmers. Mining could threaten these sensitive ecosystems by stimulating additional migration (Environmental Science for Social Changes, 2003). Recent concerns regarding the potential conflicts between mining and other land uses has prompted some communities to pass non-binding referendums banning mineral development. For example, in June 2002 the Peruvian community of Trambogrande voted to reject mining in their community due to concerns regarding the projected displacement of half of its residents and fears regarding the potential impacts of mining on the community's traditional livelihood (Oxfam, 2002). According to a study

commissioned by the mining industry, displacement may result in serious social problems, including marginalization, food insecurity, loss of access to common resources and public services, and social breakdown (Christman and Stolojan, 2002).

Regulatory framework of mining

A strong regulatory framework allows countries to set standards that companies must follow. Some experts contend that a more flexible regulatory framework is preferable than the more traditional command-and-control approach (Otto and Cordes, 2002). Others acknowledge that a minimum set of rules by which companies must operate is necessary (Warhurst, 1999). Key components of a regulatory framework for mineral development include environmental impact assessments, environmental quality and social laws, environmental liability, and monitoring capacity. Environmental Quality and Social Laws, a framework of environmental laws and regulations provides guidance to mining and oil companies regarding a country's expectations for environmental and social performance. Some countries have strong laws and regulations on the books, including soil, water and air standards; indigenous/local community rights; and requirements for decommissioning and site clean-up.

Animal Rearing

This is an important human activity in the study area. As with crop cultivation, livestock rearing is handicapped by conservative and primitive methods which have combined with environmental handicaps to restrict its expansion. Three system of livestock rearing are identified in the study area namely nomadism, semi nomadism and sedentary pastoralism (Bukar, 1997).

Transportation

The land transportation system of the study area is very poor and thus possesses a very sparse road density. The only trunk A road crossed the area from Potiskum to Gombe through Fika and Bajoga. Footpaths also exist. This type of roads link the mining sites to the collection centre usually located along the Trunk A road. The efficiency of these roads is greatly reduced during the rainy season.

Geology, Relief and Drainage

The study area falls within the basin of deposition know as the Chad basin described as the second largest area of inlands drainage in Africa and occupies part of Nigeria, Central African Republic and Cameroon. The Nigerian sector of the Basin slopes gently towards the Lake Chad, which is the main geographical feature. It consists of six distinct formations that overlie the basement, each characterized by a particular depositional environment. There are also intrusions of tertiary basalts and Jurassic Younger Granites at the southern and north eastern end of the State respectively.

The study area falls under the Keri-Keri Formation. The Formation (Tertiary) rests uncomfortably on the folded cretaceous sediments. The Keri-Keri Formation underlies the high plain lands in the north of the region near Fika-Potiskum, Daura and extends southwards beyond the Gongola river to Gombe Abba and Dukku area of Gombe State. A thickness of about 220m known in the west and southwest of the basin. However these sediments are absent at Maiduguri and drilling proved that they wedge out between Maiduguri and the Damaturu-Gashua road. Recent oil exploratory drilling by NNPC has also confirmed the absence of this Formation in Maiduguri and Baga sub-basin (Matheis, 1976).

The Keri-Keri Formation is made up of grits and reddish and whitish sandstone with well-developed cross bedding indicating a deltaic environment and a clayey grits which suggest a lacustrine environment.

Data collection

Field observation

This involved the critical observation of the nature of mining employed in the area and also the extent of physical destruction that can physically be seen on the mine sites. The mine pits and mounds of overburden dumps are indicators of degradation at all the mine sites.

Measurement

Thirty (30) pits from the selected mine sites were systematically selected. The variables measured include surface diameter and vertical depths.

The following instruments were used for the measurement:

i. Measuring Tape

ii. Writing materials

Focus Group Discussion

Focus group discussions were conducted.

One with the community Leader of Turmi being the most senior title holder amongst the three communities hosting the mine sites and some of his wards head present with him at the time of our visit.

Three Focus Group Discussions were conducted at the three mine sites with the miners on duty.

The discussions were aimed at knowing the nature and effect of the mining on the land surface and other land use activities such as farming, grazing etc.

Discussion

The nature of mining operations

The physical nature of mineral deposit and the surrounding rock, the shape and structure of the ore deposit determine the method of extraction to be used. However, the actual decision by a particular method is primarily determined by the depth of overburden that overlies the deposit.

In the study area, gypsum was found to exist at depth of 3 meters and extended vertically up to about 20 meters. The method of extraction employed is the surface types which simply involves the removal of overburden and extraction of the gypsum deposit in successive layers.

Mining operation usually commences with vertical digging with pits possessing an average surface diameter of 1.16 meters.

A distinct layers of soil within the depth of 0-3 meters is usually encountered before arriving at the soil layer which indicates the existence or otherwise of the mineral deposit. The gypsum intercalation was observed to be bedded and generally more horizontally inclined. It varies in thickness from 1cm to 5cm.

Vertical digging is replaced by horizontal digging at a maximum depth of about 20 meters. Even at such length, the mineral is not exhausted but the pits are abandoned due to shortage of oxygen or visibility problems.

Horizontal digging involves the removal of the gypsum in four directions from the main pit at right angles to one another while leaving a series of pillars carved out of the minerals to support the roof of the working. This method of operation

was observed to be wasteful as some substantial amount of the gypsum deposit is left behind as support pillars and roof.

The same types of tools are used by the miners in all the sites visited. Simple tools such as picks, shovels, diggers and head pans are employed. Other implement are rope and torchlight.

The survey also reveals that there is no particular period of operations or rest at different times of the day and night. However, mining operation subside during the hot afternoons usually 12-3 pm and at the peak of the current insurgency late last year, extraction activities during the night are relatively low.

Diameter and depth of Pits

Pit No	Gashuwa		Garin Ari		Turmi	
	Pit Diameter	**Pit Depth (m)**	**Pit Diameter**	**Pit Depth (m)**	**Pit Diameter**	**Pit Depth (m)**
1.	1.2	3	1.1	6	1.2	18
2.	1.2	4	1.1	11	1.2	10
3.	1.1	12	1.1	14	1.2	14
4.	1.05	7	1.2	10	1.2	7
5.	1.2	8	1.2	13	1.1	13
6.	1.2	11	1.2	6	1.1	8
7.	1.2	9	1.1	12	1.0	15
8.	1.1	12	1.2	9	1.2	13
9.	1.2	11	1.2	16	1.2	14
10	1.2	11	1.2	17	1.2	17

The table above shows an average surface diameter of 1.16 meters, and average horizontal depth of 11.03 meters.

In-between these pits are dotted spots of earth mounds formed by the piling of materials of overburden removed to exposed the mineral deposit.

It was found that for every pan of gypsum obtained, an estimated 5 pans of waste and overburden rock has been excavated. These are just rough estimates but provide an insight on the level of degradation that take place. These open pits and overburden dumps form a badland which also greatly disturbs movement of miners and of the minerals to the collection points.

The clearing of sites of all vegetation cover for mining operations exposes the bare soil to large micro climatic changes which alter the soil surface, making it more vulnerable to wind and water erosion.

The removal of the root systems of plants which act as binding mechanism also accelerates both wind and water erosion.

Observations reveal that most mine pits get enlarged upon exposure to rainfall thereby developing into gullies. The thirty (30) mines studied showed that gullies of over 2.5 meters have developed on almost all the abandoned pits around the mine pits. This represents a significant percentage of the mine sites. The mounds of overburden also possess steep slope that are in some cases washed back into the pits. This eventually develops into gullies.

Deforestation accelerates desertification, threatening the continuous usage of these areas.

Tunnels of up to 20 meters are sometimes dug by the miners to extract the mineral deposit. To support the roof of the tunnels, pillars carved out of the mineral are usually constructed. Although it is very rare, these pillars sometimes collapse as it happened a day to our field work visit at Garin Ari. Information from the miners indicates that over 15 trucks of gypsums were excavated from this particular pit that collapsed in the last six months.

Land use activities

The land area now under mining operations were used for various purposes amongst which include, farming, forestry, grazing and hunting according to focal group discussion conducted.

Mining activities have kept encroaching on to farmlands such that at all the mine sites, the distance to the nearest farmland is less than 100 meters. Threat of further encouragement on to farmlands cannot be ruled out as long as mining activities continue.

Farmlands have been affected by the mining related activities such as the regular flow of heavy duty trucks that use the untarred roads.

Due to the poor condition of roads, trucks often drive into farmlands to avoid getting stuck in mud or sand.

Conclusion

Gypsum mining is a major economic activity in Fika Local Government Area apart from taking over agricultural lands, the abandonment of old mine sites

without reclamation proves major environmental challenge in the area as vast lands deforested is exposed to erosion.

Recommendations

The following are recommendations:

a) Increase in the level of awareness of environmental hazard due to mining among inhabitants. The importance of maintaining environmental quality should be looked into particularly the threat encouraged by mining such as deforestation, erosion and ultimately desertification should be addressed. This could be done through public campaigns.

b) The encroachment of mining activities on agricultural land should be checked by the provision of good tarred road so that trucks no longer drive on farmlands. This road could be from the mine sites to the collection center.

c). Some of the abandoned pits could be developed into fish ponds as it is on the Jos Plateau Tin mines. In addition, water could be stored in these abandoned pits as water reservoir for dry season farming.

d). Government should enforce laws on all miners to fill back abandoned pit after utilization so that the land can be useful again.

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