Journal of Agriculture and Veterinary Sciences
Volume 7, Number 1, 2015
ISSN: 2277-0062

Effect of Coal Mining on Agricultural Land of Maiganga Coal Mining Area, Gombe-Nigeria

[1]ADAMU SANI J., [2]SABO AHMED, [2]ALIYU MELE M. and [3]MAHMOUD AISHA B.

[1]Department of Geography, Gombe State University, Tudun Wada Gombe, Gombe State, Nigeria.
[2]Department of Environmental Management Technology, Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria.
[3]Department Of Biological Sciences, Gombe State University, Tudun Wada Gombe, Gombe State, Nigeria.
E-mail: sanidaddy@gmail.com

ABSTRACT

The aim of this study is to identify the effect of coal mining on the agricultural land of maiganga coal mining area, Gombe-Nigeria. 75 questionnaires were administered to the locals, representing 15% of population of maiganga which is 300-500(2006 census). Percentage scores were used to analyze the data collected. The research has confirmed that 80% of the agricultural land at maiganga have been taking over by the coal mining company, 50% of the respondents agrees that there is a decline in their agricultural yield, 75% of the respondents agrees that there are new incidences of diseases, and also the research confirmed that 28% of the populace there are now unemployed because their farmlands have been taken over by the coal mining company. Therefore, the research recommend that government should make it compulsory the conduct of environmental impact assessment before the commencement of any developmental project even agricultural that is 50ha above to avoid a kind of damage that has been done to agricultural land at maiganga coal mine area.

Keywords: Agricultural Land, Coal Mining Area, Coal Mining, Effect

INTRODUCTION

Most steel and cement industries use coal as a fuel for extraction of iron from iron ore and for cement production. In United State, United Kingdom and South Africa a coal mine and its structures are called a colliery. In Australia colliery generally refers to an underground coal mine (Chrisman *et al*, 1980). Coal mining has had a lot of development over the recent years, from the early days of men tunneling, digging and manually extracting the coal on carts to large open cut and long wall mines. Mining at this scale requires the use of draglines, tracks, conveyors, or jacks and shearers (McCartney *et al*, 1989). Surface mining and deep underground mining are two basic methods of mining. The choice of mining method depends primarily on depth of burial, density of the over burden and

thickness of the coal seam. Seams relatively close to the surface at depth less than approximately 180ft (50m) are usually surface mined, but in some cases surface mining techniques can be used. For example in some western part of US coal that occurs at depth in excess of 200ft (60m) are mined by the open pits methods, due to thickness of seam 60-90 feet (20-30m). Coals occurring below 300ft (100m) are usually deep mined. Although there are open pit mining operations working on coal seams up to 1000-1500 feet (300-450m) below ground level; for instance TegebuHambach in Germany (USDI, OSMRE, 1987). Coal mining can result to a number of adverse effects on the environment. Surface mining of coal completely eliminates existing vegetation, destroys the genetic soil profile, displaces or destroys wildlife and habitats, degrades air quality, alters current land uses and to some extent permanently changes the general topography of the area mined. These often result in a scarred landscape with no scenic value. Rehabilitation or reclamation may mitigate some of these concerns and is required by U.S Federal Law, especially the surface mining control and reclamation act of 1977. If underground mine tunnels collapse, this can cause subsidence of land surface. During actual mining operations, methane a known greenhouse gas may be released into the air. And by the movement, storage and redistributions of soil, the community of micro-organisms and nutrient cycling processes can be disrupted (USEPA, 2005). According to Lenntch, (2008) heavy metals are defined as those metals that have their densities in excess of $5g/cm^3$, the term heavy metals are natural components of the earth's crust. Some of them (e.g. copper and zinc) are also called trace elements biologically, because in small amount they play a vital role in plants, animals and human nutrition, (Monier-Williams, 1994). However, they could be toxic at higher concentrations, heavy metal poisoning could result, for instance, from drinking contaminated water, high ambient air concentrations near emission sources, intake via the food chain.

Heavy metals are dangerous because they tend to bioaccumulate, bioaccumulation means an increase in the concentration of a chemical in a biological system over time, compared to the chemicals concentration in the environment. Such metals accumulate in living tissues anytime they are taken up and stored faster than they are broken down (metabolized) or excreted. Soil is an important component of the biosphere because it does not only serve as a geochemical sink for contaminants, but also acts as a natural buffer controlling the transport of chemical elements and substances to the atmosphere and living organisms. However, the most important role of soil is it productivity, which is the basis for human survival (Kataba-Pendias, 2000). Longer than in other

compartments of biosphere and the contamination of soil especially by heavy metals appears to be virtually permanent (Kataba-Pendias 2000).

LITERATURE REVIEW

Heavy Metals in Soil

Soil is an important component of the biosphere because it does not only serve as a geochemical sink for contaminants, but also acts as a natural buffer controlling the transport of chemical elements and substances to the atmosphere and living organisms. However, the most important role of soil is it productivity, which is the basis for human survival (Kataba –Pendias, 2000). Longer than in other compartments of biosphere and the contamination of soil especially by heavy metals appears to be virtually permanent (Kataba-pendias 2000).

Soil Pollution

Industrial wastes are a major source of soil pollution that originate from mining industries, chemicals industries, metal processing industries, and the like. These wastes include a variety of chemicals like heavy metals, phenolics etc. These metals have damaging effects on the plants themselves and may become a health hazard to man and animals. Above certain concentrations and over a narrow range the heavy metals turn into toxins. (Bitton *et al*, 1986). Moreover, these metals adversely affect natural microbial populations, leading to disruption of vital ecological process. Currently, microorganisms are being used as potential bio-indicators for the assessment of chemical risk to the ecosystem (Bitton *et al*, 1986). Heavy metals continue to receive increasing attention due to the better understanding of their toxicological importance in ecosystems, agricultural and human health (Chojnacka *et al*, 2005). Soil may also be contaminated by heavy metals such as zinc (Zn), cadmium (Cd), lead (Pb) and copper (Cu), due to different environmental impacts such as sludge or urban compost, pesticide and fertilizer, emissions from municipal waste incinerators, car exhaust, residues from metalliferrous mining, coal mining waste and the mental smelting industry. These and other heavy metals are also considered to be essentials micronutrients and are required in trace amounts for plant to complete their life cycles (Chojnacka *et al*, 2005).Heavy metal content in soil has a greater importance due to the fact that soil effectively act as a reservoir which, after temporary storage of metals, can act as a source under certain conditions therefore, soil is both a source and a sink for metal pollutants (Chojnackav *et al,* 2005).

Heavy metal concentration in the soil of urban areas cannot be attributed solely to geological factors alone. Human inputs also play a predominant role in the development and modification of the soil from these areas although non-urban soils have been reported to also be polluted by heavy metals, urban soil have higher concentration of heavy metal pollutants (Chirenje, *et al*. 2003, Oluwole, *et al*, 1994). When soil is amended with sewage sludge a new source of heavy metal is introduce unless the retaining properties of the resulting amended soil are increase in accordance with this, heavy metals may spread to the surrounding environment (Shrivastava, and Banerjee, 2004). The anthropogenic deposition of heavy metal in agricultural soil will either become detrimental to plant growth or to the consumer of the harvested crops depending on the chemical form of the metals present in the soils (Chaney and Giordano, 1977; Latterell *et al*, 1978; Mahler *et al*, 1980). Plants are known to take up and accumulate heavy metals from contaminated soils (Singh and Narwal, 1984; Bojakowska and Kochany, 1985; Pulford and Watson, 2003; Madejon *et al*, 2003). Another major route of soil contamination is through atmospheric deposition of heavy metals from point source such as metaliferous mining, smelting and industrial activities. Other non-point source of contamination affecting predominantly agricultural soils include inputs such as fertilizers, pesticides, sewage water, sewage sludge, waste from coal mining, manures and composts (Singh *et al*, 1984).

Types of Coal Mining

Coal is classified based on the level of carbon it contains and the amount of energy it can produce. Coal that contains a high amount of carbon is referred to as high rank coal. They have a low hydrogen and oxygen content and have a high heat value. Low rank coal has low carbon content but contain a high amount of hydrogen and oxygen. The various types of coal include:

Lignite

This is formed when peat is first transformed to coal. It's the lowest rank of coal and often called ***brown coal***. Lignite has about 25%-35% carbon content and is very moist and soft since it has not under gone the extreme heat and pressure experienced by the other types of coal. It's mainly used to generate electric power (William p. and Mary Ann Cunningham, 2005).

Sub-Bituminious Coal

This has about 35%-45% in carbon content and is organically more mature than lignite. It's used for steam electric power generation and also a source of light

aromatic hydrocarbon for chemical industries (William p. and Mary Ann Cunningham, 2005).

Bituminious Coal

It's called hard coal it has a high carbon content of about 45%-86% and a high heating value so it's used largely in the generation of electricity and in steel and iron industries (William p. and Mary Ann Cunningham, 2005).

Anthracite

It's very hard and glossy and used mainly for residential and commercial heating. It has a very high concentration of carbon. Its carbon content is about 86%-97% (William p. and Mary Ann Cunningham, 2005)

Graphite

This contents the highest amount of carbon but it's not used as fuel due to the fact that it's hard to burn. It's used in making pencil. Coal is used in various sectors and in various ways. It's used in heating and also in generating electricity. It's used to make coke; this is used to smelt iron for making steel. By-products of coal ethylene and methanol are used in plastics, fertilizer, synthetic fibers and medicine. Furthermore it provides foreign exchange because it's a tradable good so it's export (William p. and Mary Ann Cunningham, 2005).

Effect of Coal Mining on Soil and Vegetation

Mining operations severely alters the landscape, which reduces the value of the natural environment in the surrounding land. The land surface is dedicated to mining activities until it can be reshaped and reclaimed. If mining is allowed, resident human populations must be resettled from the mine site; economic activities such as agriculture or hunting, gathering food and medicinal plants are interrupted. Existing land uses, such as (livestock grazing, crops and timber production) which are temporarily eliminated from the mining site destroyed the genetic soil profile and wildlife habitat alters current land uses, and to some extent permanently changes the general topography of the area mined (William p. and Mary Ann Cunningham, 2005). Removal of soil and rock overburden covering the coal resource may cause burial and loss of top soil, exposes parent material, and creates large infertile wastelands. Soil disturbance and associated compaction result in conditions conducive to erosion and flood. Soil removal from the area to be surface-mined alters or destroys many natural soil characteristics, and reduces its diversity and productivity for agriculture. Soil

structure may be disturbed by pulverization or aggregate break down (William p. and Mary Ann Cunningham, 2005).

METHODOLOGY

Fig. 1 Map of Nigeria Showing Gombe State

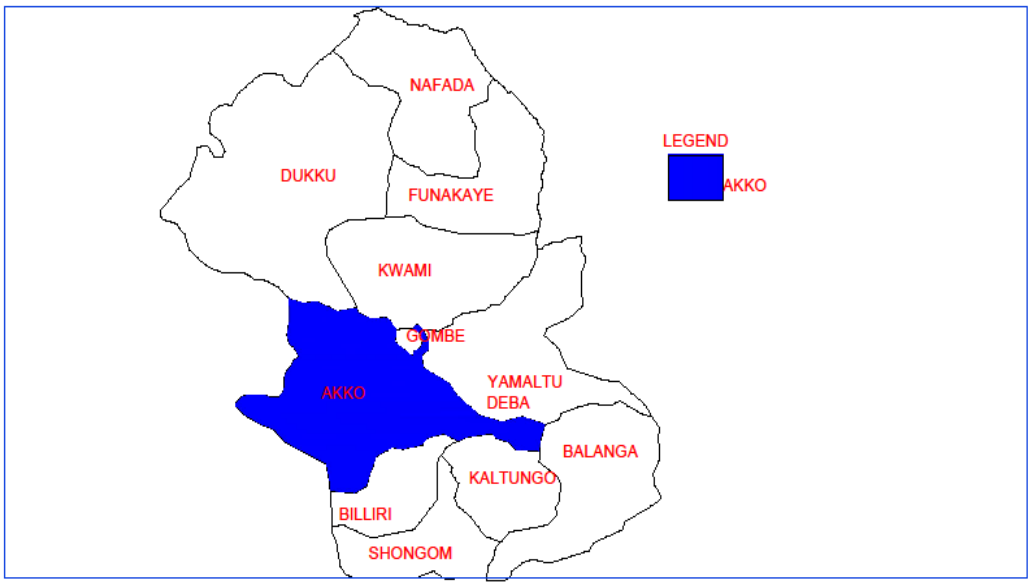

Fig.2: Map of Gombe State showing Akko LGA

Fig.3: Google Earth of Maiganga Coal Mine Area

Plate 1: How Coal Mine Activities is Destroying Agricultural Land at Maiganga Coal Mine Area

RESULT AND DISCUSSION

The Effects of the Coal Mining Activity Effects on Agriculture

PROBLEMS	NO. OF RESPONDENTS	PERCENTAGE (100%)
Loss of productive farm land	60	80
Decline in yield	50	66.67
New disease infestation	75	100
Decline in water supply for irrigation	75	100
Decline in livestock	75	100
Rangeland depletion	75	100
Change in crops grown	70	93.33

Source: Field Work, 2014.

From the above result, it can be seen that the resultant effects of the mining activity on the agricultural land use of the Maiganga have proven to have manifested at 80%.The majority of the respondents believe that they have been impacted negatively as outlined in the table above, which claim that much of the vast lands they own were converted to the company's potential mining site (with insufficient compensation), and as such they are left without much productive land to grow their crops. The decline in yield as stated by the 50 respondents was due to the effect of dusts on the crops, thus finding it

difficult to thrive. They claim that before the commencement of the mining activity, an area that used to produce 30 bags of maize now produces about 15 bags or less, thus the land yield has reduced by 50% or less. Other negative impacts on the crops include; change in crops grown, new disease infestation, decline in the water supply for irrigation, decline in livestock and rangeland depletion are all proven by the 75 respondents (100%) to have been tangibly real. There is a change in crops grown, for example maize and beans were the crops produced in large quantity before, but now due to the impact of the mining activity water melon are grown largely, while economic trees can no longer thrive as well. The decline in water supply as presumed by the 75 respondents (100%) was due to the relative insufficient water supply from the borehole the company constructed for the community, which is not supplying enough for the people let alone for their irrigation farming, unlike when they were in the former location where the water was much better abundant than in the new location. Regarding livestock rearing, cows, sheep and goats were abundant there but after the commencement of the mining activity none of which can be found in the community because rangeland has been depleted already and the residue they used to get from the agricultural output can no longer be provided. Not only the un-productivity of the land disfavors their farming but also the infestation of new insects of maize and beans deplete much of the produce.

OTHER RELATIVE EFFECTS

PROBLEMS	**NO. OF RESPONDENTS**		**TOTAL**	**PERCENTAGE (100%)**		**TOTAL**
Employment	Unemployed	Employed	75	Unemployed	Employed	
	21	54		28	72	100
Occurrence of minor accidents	75		75	100		100
Comfortability with the new location	Comfortable	Uncomfortable	75	Comfortable	Uncomfortable	100
	10	65		13.33	86.67	
Prevalence of new diseases	75		75	100		100

Source: Field Work, 2014.

The above table shows other relative negative impacts to agriculture; such impacts are termed indirect impacts because they do not directly pose threat to land, crops or water supply as in the case of irrigation farming, but affect human ability to practice the agriculture, also affect human health and

wellbeing. Unemployment according to the 75 respondents, 21 of them (28%) are employed, including those few that are employed by the company, government and entrepreneurs. Much of the unemployed were relegated to become such because of the effect of the mining activity on their potentials such as land and water source. The 75 (100%) of the respondents have claimed that occurrences of minor accidents that at times lead to even deaths and serious injuries have been recorded positive, the cause is as a result of the dusts generated when transporting coal from the quarry to the company's plant, and at times the blasting sound frightens people causing small injuries. From the 75 respondents, 10 (13.33%) responded that the new location is comfortable while 65 respondents (86.67%) said the location is uncomfortable, their claims against the uncomfortability of the location were; the new location lacks enough water supply, unsupportive land in terms of agriculture, and sickened commercial potentialities. Also, among the outlined problems, the respondents 100% (75) have indicated that cases of new diseases have manifested most common as respiratory infections and many unusual symptoms have as well manifested that even claimed lives and poses threat to health and wellbeing of young and old.

CONCLUSION AND RECOMMENDATION

This research work has confirmed that about 80% of agricultural land at Maiganga have been taking over by the coal mining company,50% of the respondents agrees to have observed a decline in there agricultural yield, 75% of the respondents agrees there are new incidence of diseases as a result of damages done to agricultural land by the mining company and also the respondents agrees that 28% of resident in the community are now unemployed as a result of the taken over of the agricultural land by the mining company. Therefore, the research recommend that government should make it compulsory the conduct of environmental impact assessment before the commencement of any developmental project even agricultural that is 50ha above, the company should as a matter of urgency create a buffer zone between the coal mine area and the remaining agricultural land at the area, and also the company should established vocational centre at the area for the locals to be train with skills that will make them self reliant now that their agricultural lands have been taken over by the coal mining operations.

REFERENCE

Bitton, G. and Dutka, B.J ;1986, "*Introducing and Review of Microbial Toxicity Screening Procedures*", In B.J Dutka and G Bitton (eds), Toxicity Testing using Microorganisms, Vol.1, CRC Press, Boca Raton, Florida, pp.1-26

Chaney, R. L. and Giordano, P.M. (1977). "*Micro Element as Related to Plants Deficiencies and Toxicity*". In: Elliot and F. J. Stevson (ed.) Soil Science Society of America, Madison Wis, USA,PP 234-279.

Christman R.C., J. Hesibeck, B. Sedik, W. Murray, and W. Wilson (1980)"*Activities, effects and Impacts of the Coal Fuel Cycle for a 1000MW Electric Power Generation Plant*". Washington DC: US Nuclear Regulatory Commission.

Generation in India *During Post- Reformera, International Journal of Global Energy.*23, 15-28.

Jayanta B. (2007). ***Principles of Mine Planning*** *(2nd edition.*). Wide Publishing. P. 505.

K Chojnacka, A. chojnacki, H. (2005). "*Bioavailability of Heavy Metals from Polluted Soils to Plants*", Sci. Total Environ.337 (2005) 175-182.

Kataba-pendias,A.(2000). " *Trace Elements in Soils and Plants".* CRC Press, London.

Mary Ann cunningh00000an and William p. Cunningham (2005*): Environmental Science A Global Concern Eight.* Pp 148-149 Edited by kathllen R. Loewnbarg, Published by McGraw-Hill, Avenue of the American, Now York.

Mcartmey, Martha W. (1989). "*Historical Overview of the Midlothian Coal Mining Company Tract. Chester Field country Virginid*" December 1989.

Ministry of land and survey Gombe (2003).

Monier-william, G.W.(1994). " *Trace Element in Food*". Chapton and Hill Limited. London Pp 238-281.

Oxford Dictionary Advance Learner (2006*) pp.250.*

Shanmugam, K. R. *et al*, (2005): ***Efficiency Analysis of Coal Based Thermal Power***

Sharma, K. (2005*):* **Impact of Coal Mining on Vegetation**; A Case Study in Jaintia Hills District of Meghalaya, India. M. Sc. Thesis Submitted to International Institute for Geo- Information Science and Earth Observation Ens-Cheme, Netherlands & Indian Institute of Remote Sensing, NRSA, Department of Space, and Dehradun, India.

Shrisvastava, S.K. and Banerjee, D.K.(2004)."*Speciation of Metals in Sewage – Sludge and Sludge Amended Soils*". Water, Air and Soil Pollution, 152, 219 – 232.

U.S Environmental Protection Agency, Philadelphia, PA (2005)."*Mountaintop Mining/Valley Hills in Appalachia. Final Programmatic Environmental Impact Statement*"

U.S. Department of the Interior, Office of Surface Making Reclamation and Enforcement (1987). "*Surface Coal Mining Reclamation 10 Years of Progress, 1977-1987*". Washington DC: US. Government Printing Office.

References to this paper should be made as follows: Adamu Sani J. *et al* (2015), Effect of Coal Mining on Agricultural Land of Maiganga Coal Mining Area, Gombe-Nigeria. *J. of Agriculture and Veterinary Sciences,* Vol. 7, No. 1, Pp. 23 – 34.

Biographical Note: Adamu, Sani Jauro is a Lecturer at Geography Department, Gombe State University and was born in early eighties at Gombe; he went to Ibrahim Bako Primary School Bauchi and did his secondary education at Gombe Science Secondary School respectively. Thereafter, he proceeded to Abubakar Tafawa Balewa University Bauchi for his B.Tech. In Environmental Management Technology and graduated in the year 2008. In his pursuit of academic excellence, he has also finished his MSc. in Geography (with specialization in Land Resources Development) at Bayero University Kano, Geography Department.

Biographical Note: Sabo, Ahmed he obtained a BS.c. in Botany (First Class Hons) from University of Maiduguri, MSc. in Environmental Management from Derby United Kingdom (UK) and PhD. In Environmental Management Technology from Abubakar Tafawa Balewa University Bauchi (ATBU). He is a Senior Lecturer and currently the Head of Department, Environmental Management Technology Department (ATBU Bauchi).

Biographical Note: Aliyu Mele Mahmud he obtained a B.Tech. (Hons) in Environmental Management Technology from Environmental Management Technology Department of Abubakar Tafawa Balewa University Bauchi (ATBU).

Biographical Note: Mahmoud Aisha Babayo, She was born in the nineties and she went to Gombe State University where she is currently a final year student at the Department of Biological Sciences.