Swift Journals 2062-2684

Swift Journal of Geography and Regional Planning
Vol 1(2) pp. 012-024 December, 2015.
http://www.swiftjournals.org/sjgrp

Original Research Article

An Assessment of Environmental Quality; a Case of the Jos Plateau Tin-Mining Region (JPTMR)

Jiriko, G.K. [1] Wapwera, S.D[2] Mallo, D.M.[3] & Rikko, L.S.[4]

[1, 2& 4] Department Of Urban And Regional Planning, Faculty Of Environmental Sciences
University Of Jos.
[3]Department Of Estate Management, Faculty Of Environmental Sciences,
University Of Jos.

Accepted 7th December, 2015.

The presence of heavy metals and radioactive substances in most mining settlements has posed a great challenge with varying dimensions especially environmental quality. Hence, this paper seeks to assess the environmental quality of the mining regions by identifying their sanitary practices and the level of satisfaction of the inhabitants of the region. Using a case study approach ten settlements were considered. The secondary data used were obtained from reports about the previous Tin-mining activities within the region, whilst the primary data were from the questionnaire administered 300 to the inhabitants and observation of the regions concerning sanitary practices. The sampling technique adopted for the region stratified random sampling according to the extent of damage to the environment inhabited. The secondary data was analysis using thematic and content analysis while the primary data from the questionnaire was analysed using analysis of variance. The results revealed that the socioeconomic characteristic of the inhabitants, structure and aesthetics of the environment. Sewage disposal very poor, waste/refuse collected are disposed into Tin-mining ponds, leading to pollution as drainages are not available, and the available ones are not properly cleared at regular intervals. These serve as breeding grounds for mosquitoes, and other insects. Based on the results obtained recommendations were made concerning the state of the environment considering the pre-existing prevailing conditions inherent in the region to help the academia, practitioners and policy makers.

Keywords Assessment, Environmental Quality, Jos Plateau Tin-Mining Region

INTRODUCTION

Transformation through technological advancement has improved the Quality, aesthetics and durability of housing, which in turn has influenced the built environment as observed by Anderson (2000). Yinusa (1985) had earlier explained that during the pre-colonial and colonial eras in Africa and other parts of the world, building construction was greatly influenced by traditional culture. In an environment such as the Tin Mining Region, which has experienced neglect, long after the active mining activities, serious problems of inadequate facilities, utilities and services in relation to dwellings are evident as observed by Obateru (2004) and Olaseni (2006).

Peculiarities do exist in most mining regions found in both developed and developing countries but the differences occur as positive measures are employed to curb the many problems in most developed countries, whilst in the developing countries most mining regions are neglected, poor maintenance, poor sanitary condition, unsafe environment (dead traps), inadequate facilities, services and utilities, availability among others (Anderson 2000). This in turn affects housing condition within the region. Tin mining activity has devastated and degraded the environment, as a result of the use of heavy machines and equipments, engaging in open- cast mining of Tin and other minerals such as casseterites and columbite. Consequently the landscape is denatured and characterize by steep sided spoils 'Hills' i.e moulds of materials from excavations, Multi-coloured ponds or lakes, which are numbered at about six hundred (600) as observed by Eziashi (2000).

The assessment of environmental quality around houses that present their conditions employ varying measurement of environmental aesthetics and visual aspects of the environment. Exploration and exploitation of minerals from the earth have always resulted in deviations from the natural state of the environment as observed by Mbaya, (2013). These changes differ from one area to another. Adedayo (2000) in the study of the environmental sanitation and waste management

Corresponding Author: Jiriko, G.K., Department of Urban and Regional Planning, Faculty Of Environmental Sciences, University of Jos.
Email: wapwera@gmail.com

policies at the local level in Nigeria observed that the environmental problems such as sewage disposal, public conveniences and general cleanliness and hygiene must be explained rather by the wide gap between policy goals and achievements. Urban communities have shown concern for environmental sanitation whilst their local counterparts are not as observed by Omuta and Onokerhoraye (1986). In similar studies by Obateru (2004) conducted on environmental quality shows it was an upcoming phenomena and that the existing environmental policies are urban bias, as they were formulated mainly and implemented from urban considerations without a corresponding consideration for other regions (rural). It is also evident that while the socioeconomic benefits accruing from mining activities are positive and are of prime importance to the inhabitants, the environmental consequences of the mining are blatantly disregarded.

This is necessitated by the fact that housing is part of the built environment which is an aspect required to trigger socioeconomic and other activities within and around the abandoned Tin-mining region of the Jos Plateau. As there are no efforts either from government or individuals put in place to address this problem of environmental quality, hence it has become pertinent at this juncture to draw the attention of those in academia, practitioners and policy makers concerning the implication of the neglect of the derelict environment.

It is against this backdrop that this paper seeks to examine the implication of environmental quality in the Tin-mining region of the Jos Plateau with a view to develop a guidance document to assist academia, practitioners and policy makers in government to ensure a better environmental condition through appropriate mining regulation in line with best practices. This would be done by examining the environmental quality, the effects/impacts of the Tin-mining activities on the quality of environment and housing dwelling units as well as the level of satisfaction of the inhabitants with infrastructure and social amenity provision in the Tin-mining region.

LITERATURE REVIEW

Environmental Quality Sanitation

A conducive environment most be one that is free from all forms of life sustaining health hazards, Shat (2005). Dirty, unkempt and depressing environment can contribute to personal dissatisfaction and apathy in the neighbouring units. The relationship between environmental quality and human health can always be tested by improving the environment, through monitoring their health status over a considerable period of time, before and after improvement of the neighbourhood (Ibid).

Children who live in better environment are having remarkable improvement in physical health, better school attendance record, high rate of social interaction and achieve much better grades too, (Wilner and Walkey 1963). This could be attributed to the fact that there are spaces in the dwellings and room for learning in a serene environment where it is quite and calm. The need for environmental sanitation services motivates individual action, but again, they depend heavily on an infrastructure. There are incentives to private action, but the capacity of individual residents to provide minimum services depends heavily on the public investments (Montgomery 1988) and Mbaya, (2013).

Furthermore, logic and health data are always available to demonstrate the relationship between environment and human health. Tuberculosis, dysentery, cholera, skin disease and childhood infection are always higher among occupants in slum areas, rural settlements which are caused by poor ventilation, lack of provision of general sanitary conditions (Shat, 2005).

Several reports show some degree of the linkages between land use and transport which are indicators, and the implications for environmental quality (Newman, 1990). Collection and disposal of sewage and other liquid and solid wastes is a major public health problem and a vital factor affecting the quality of most environments. Onibokun (1990) observes that waste disposal is a major factor in the residents' perception of the quality of urban neighbourhood and it also affects the value of the property. He laments that some areas are receiving more attention in terms of refuse collection and disposal services, others are served intermittently or not at all. This could be seen in a situation where the exercise is done in urban areas while it is not done in the rural areas.

The context of environment is much more than a physical article, but includes the general environment within which the structure is located (Sule, 1990). Finally people living in unsafe areas, lacking environmental sanitation such as refuse disposal, toilets, bathrooms and provision of health services always suffer losses and damages, since they are more vulnerable to diseases than those living in a safe environment as observed by Mbaya, (2013).

A healthy environment is characterized by having facilities, such as flush toilets, (water closet), bathrooms, (with shower), pipe borne water, electricity among others, while others do not have such facilities. This determines the state of the environmental quality. This concept is for the measurement of environmental aesthetics, or visual aspects of the environment. The physical quality of the environment that is unattractive, which include noxious domestic waste, unkempt building's surroundings, open gutters, poor drainages and other attractive elements such as parking unused vehicles, among others. Thus the concept is used in measuring the condition of the physical environment in relation to the basic facilities available in the neighbourhoods.

The conditions, such as very good, good, fair, and poor in the selected settlements are considered on streets and land uses. The presence of access roads, drainages of good, fair and poor system, and the general cleanliness of different dwelling units, are considered as the general environment.

The effects/impacts of the Tin-mining activities on environmental quality.

The effects and impacts of the Tin-mining activities on environmental quality would be considered in two sections. Firstly, considering the impacts of the activity and secondly the effects on the housing, water, soil and air as observed by Wapwera, Egbu, Parsa & Ayanbimpe, 2014 in a related study. This economic activity is the leading cause of adverse environmental impacts on the region as a result of exploration and exploitation processes. These processes and methods of mining have varying degrees of environmental impacts/effects on the landscape as demonstrated in Table 1.1

Table 1.1 illustrated that the exploration of Tin and mineral extraction as well as its related environmental activities have both general and social impacts that have resulted in spoil hills that estimated at about (41%) occupying an area of 325 sq km of the Jos Plateau, while the area destroyed was about 267sq km which is characterized by mining paddocks and Tin tailings as observed Howard, (1975) in a related study.

Table 1.1: Environmental Impacts of Exploration of Tin Mining Activities

Mining activities	General effects	Social impacts
Exploration	Landscape disturbance	Aesthetic deterioration of the landscape path construction and trampling in wilderness areas.
Mineral Extraction	Land degradation ecosystem destabilization	Land surface devastation including erosion, land subsidence, disruption of drainage system, deforestation lowering and construction of water table.

Source: Abbott, (2002).

Table 2: Radioactive substances and radiation/ionization level in study area
(Source: Adopted from Adiuku-Brown & Ogezi, 2004)

Hazardous pollutants	Health impact	Dose rates (rem/yr)	Implication	Substances emitted (radionuclides) steps(x)
Gamma Radiation	Injury to brain, damage eye leading to cataract, ovaries,testes (sterility), bone marrow and inability of the body to fight infection.	0.03-0.058 rem/yr	Low(permissible exposure)	Radium (Ra) Thorium (Th)
alpha Radiation (δ)	Injury to brain, damage eye leading to cataract, ovaries,testes (sterility), bone marrow and inability of the body to fight infection.	0.16- 0.32 rem/yr	low(permissible exposure)	Radium (Ra) (-226 series) Thorium (Th) Uranuim(U)x 8
beta Radiation (β)	Injury to brain, damage eye leading to cataract, ovaries,testes (sterility), bone marrow and inability of the body to fight infection.	0.16- 0.32 rem/yr	Low (permissible exposure)	Radium (Ra) Thorium (Th) Uranuim(U)x 6 (-238 series)

Table 3: Conditions and characteristics of the built Environment in the study area
(Source: Wapwera, 2008; 2010; Ayanbimpe,Wapwera and Kuchin, 2010)

Condition of Buildings	Characteristics	Implication
Very good	No need for repairs, have the needed basic amenities such as water, electricity, kitchen, toilets, good refuse/sewage disposal and in a good environmental quality	The building is physically and structurally sound.
Good	Requires minimum level of repairs. It must have sound foundation and walls, with little or no cracks or leakages on the roof. With the needed basic amenities	It is structurally sound
Fair	Have cracks on the walls, leaking roofs, and broken windows to enhance its physical condition and bring it back to its original state. It may be lacking in some basic amenities	The buildings structurally require some level of repairs.
Poor	Devoid of basic amenities, and when available are not adequate. Some parts of the buildings have collapsed and are not habitable. Such houses require immediate reconstruction they may not have possess any facilities at all.	The physical structure of the building requires major/minor repairs or renovation and may require urgent attention in order to upgrade the building and make it habitable (derelict state).

Table 4: Occurrence of Fungal contamination of indoor air within the Jos Plateau Tin-mining region (JPTMR) (Source: Ayanbimpe, Wapwera and Kuchin, 2010)

Features of questionnaire	Number of positive responses	Number of fungal isolates (%)
Unplanned settlement	72	55 (14.7)
Age of building (Old)	61	43 (11.3)
Lack of toilet/drainage facility	87	24 (6.3)
Lack of waste disposal facility	87	45 (11.8)
Dampness of building	87	87 (22.9)
Mold growth in the home	17	42 (11.1)
Symptoms (respiratory, eye)	106	24 (6.3)
Arthropod infestation	126	60 (15.8)

Ponds pose a danger, and constrain movement of people, goods and animals; with this, the zone is tagged 'Disaster' area. Dorman (1978) asserted that about 30% of the land within the immediate vicinity of Jos may be unproductive either due to mining, rock outcrops or existing gullies. Some of these gullies resulted from the mining activities. She established that the depths and the width of the gullies were up to 12.2m and 2.4m respectively on the Jos plateau.

Dorman (1978) estimated the extent of gullies on the entire Jos Plateau to equal the lengths of about 7,240 km, representing a soil loss of about 100,000 tonnes, which have increased over the years. With all these and many more the Jos Tin mining region is threatened, with the presence of the moulds and ponds that are a potential danger to human lives and the physical environment.

These conditions, according to Jiriko, (2001), make the region unsuitable for human habitation (residential). And other land uses, which has influenced to a large extent the housing condition, presenting an unhealthy scenario within the region. For instance, it is on record that between the periods of September to December 1982, two (2) children were reportedly drawn in the pond and from then till date countless numbers of people have lost their lives and property to the ponds.

The effects of heavy metals and radioactive substances, microbial contamination and microbials on housing, water, soil and air resulting from Tin-mining activities within the study region has both medium and long term effect because these substances have become intrinsic components of the environment hence there is great need for the consideration of the environmental quality for the environment to be a habitable as there is a continues increase in the demand for land due to the increase in the population.

Wapwera, et. al (2014) observed that there are varying degrees of damage to the physical environment as a result of the Tin-mining activities and that the impact of this activity gives rise to a plethora of substances such as; heavy metals, radioactive substances and microbial contaminants with medium to long term effects on the inhabitants within the region of activities, hence the region is in dearth need of remediation to mitigate against any future effects. Proximity of ponds to residences has a multi-dimensional effect on housing because it has different facet ranging from physical, social, economic, political and cultural among others (Jiriko, 2001). The typical environmental impacts caused by mining activities ranges from diversion of rivers, water siltation, landscape degradation, deforestation, destruction of aquatic life habitat, and widespread pollution amongst others as most industrial activities damage the physical environment at varying degrees because mining industries have numerous phases of extraction processes which serve as potential source of damage to the environment as observed by Benevento, et al., (1997), Lee, Chon & Jung (2001), Ajayi (2008), Butt (2010), Ayanbimpe, Abbah & Ior (2012) and Wapwera, et. al (2014).

Furthermore, the resultant damage through excessive mining using heavy machines and equipment's has therefore become conspicuous and severe to be ignored as observed in the Tin-mining areas in Malasia and China. In Jos Plateau, Nigeria, with the decline in the economic activity, after a rising affluence, it has left the inhabitants of the region with the mining scar characterised by mounds, ponds, Tin-tailings and other hard metals which makes the area vulnerable to erosion as observed by Leblanc et al (2000), Lee, Chon & Jung (2001), Lee, Chon & Jung (2001) and Wapwera, et. al (2014).

Tin-mining activity has left the inhabitants of most mineral mining areas without any source of livelihood in both developed and developing countries. Thus, they have questioned the need for Tin/Cassiterite exploitation which was to bring about economic growth, but have become a potential source of great pollution and a destroyer of the environment and now desiring various conservation, protection and mitigation measures to bring about a clean and healthy habitable environment (Benevento, et al., 1997; Ajayi, 2008; Wapwera, 2008; Butt, 2010).

Tin in its natural state does not cause any harm and not very toxic to any kind of organism in the environment, because it has both chemical and biological components. It accumulates in water and soils for many years and its concentration rises. Ajayi, (2008), Alshachi (2009), Butt (2010), Ayanbimpe, Wapwera & Kuchin (2010) have argued that when humans absorb Tin bonds and other substances such as lead through food, breathing and through the skin. The intake of these substances can cause the following; Eye and skin irritations, Headaches, Stomachaches, Sickness and dizziness, Severe sweating, Breathlessness, Urination problems and with a Long-term effects such as: Depressions, Liver damage, Malfunctioning of immune systems, Chromosomal damage, Shortage of red blood cells, Brain damage (causing anger, sleeping disorders, forgetfulness and headaches. Other symptoms such as abdominal pain, nervous disorders affecting growth and ultimately leading to kidney failure in children, especially fast growing under five year-olds, are most at risk as observed by Barry, (2010) when lead is absorbed.

Hence there is a move to strike a balance between benefitting from mineral exploration and serious damage to their environment where humans live, work and play. The effort here is geared towards achieving an environmental sustainability. According to Brundt land report (1987), it says that recognizing the fragility of our environment and ensuring that development can meet the need of the present without compromising the ability of future generation to meet their own needs. Therefore, protect the natural environment, contain

environmental impacts and reduce reliance on non-renewable resources.

Studies related to environmental impact assessment in mining sites have shown evidence of tailings transported through streams (Leblanc et al, 2000; Lee, Chon & Jung, 2001; Marques et al, 2001). Zuhairi et al (2007) has observed that mine wastes or tailings at abandoned mines left exposed to air and water has produced acidic water and soils. Based on the aforementioned Tin-mining areas are not areas to be habited, but for the fact that there is pressure on land, areas that were previously abandoned, are now being habited leading to numerous problems due to pollution and contamination of soils, surface and underground water with toxic substances as observed Gyang and Ashano, (2010) and Ayanbimpe, Wapwera & Okolo, (2011) as cited in Wapwera, et. al (2014).

Douglas (1996) had observed that there is a high concentration of heavy metals, from waste and Tailings eg. Pb, As, Cu, Cr, and Ni. Alshaebi et al, (2009) also observed that there is mass movement resulting in large volumes of the sediments of these substances to rivers (rain water dragging waste into drainage track) causing severe flooding and erosion problems in both rural and urban settlements in the region, topographic depressions compared to other locations, destruction of natural habitats, formation of wasteland (mining ponds, moulds, tailings among others), and radioactive materials which makes the region highly unhealthy for habitation (Benevento, et al., 1997;Jiriko, 2001; Ibeanu, 2003). Based on this, it has become very difficult for basic infrastructure to be provided within the region. But with the pressure on land in the surrounding areas these abandoned mine areas are now being inhabited, but lack the basic infrastructure for growth and development (Jiriko, 2001; Ibeanu, 2003; Gyang and Ashano, 2010).

The source of livelihood for the inhabitants of the tin mining areas, and its environs, which is land, has been made derelict. 80-90% of the people living in these areas are peasant farmers who depend on land for their agricultural activities and as such, this has affected their socioeconomic life, which also serve as the bases for the condition of a good quality housing for habitation presenting an unhealthy scenario which is depleted (Jiriko, 2001, Ibeanu, 2003; Wapwera, Parsa & Egbu, 2011).

Wahab (2007) in a related study describes housing as the physical structure or house (temporary or permanent) which provides shelter for many, plus all the auxiliary infrastructure (facilities, utilities and services) which contribute to the physical, health, mental and material well being, comfort and satisfaction of individuals and their families. Consequently, the world habitat declaration about the right of humans to housing, has observed that poverty has various manifestations, including lack of income, homelessness and inadequate housing, individuals and households who lack safe, secure and healthy shelter with basic infrastructure such as piped water and adequate provision for sanitation, drainage and the removal of household waters suffered from housing poverty (Obateru, 2004; Wapwera, 2008).

Ibeanu (2003), Agbola, Nwokoro & Kassim (2007), Ayanbimpe, Wapwera & Kuchin (2010), Ayanbimpe, Abbah & Ior (2012) and Wapwera, et al., (2014) have observed that the extent of radioactive contamination in the mining communities has not been carefully documented by Doctors and public health specialists, thus the multi-generational pattern of severe health effects which manifest shortly after the mining activities declined, was possible because it affected the soil, air and water as well as the housing in the regions. The numerous national housing policies (1991 and 2006) (NHP) were not achieved principally due to lack of political will. The issue of housing quality has not been adequately addressed. The policies themselves are urban bias and the agencies to implement them lack an institutional framework for the implementation (Dung-Gwom, Pwat & Hirse, 2008).

The level of satisfaction of inhabitants on the quality of environment and housing

Based on the aforementioned the substances have profound influence on the health, efficiency, social behaviour, satisfaction, productivity and general welfare of the individual and the community. Thus the importance of housing cannot be overemphasized as it relates to the provision of good health and welfare. This has not been easy for the poor and low income, in spite of the numerous declarations, policies and programmes aimed at providing this basic necessity of life. The housing condition in any location does not matter to most occupants, but the occupancy ratio/rate most be considered.

Occupancy ratio/rate is the habitation of persons in a room or house as observed by Ratcliff (1981). The density of an area and of a dwelling shows the degree of comfort that exists within the dwelling unit and throughout the neighbourhood. In a related study by Fayankin (1984) he considered the relationships between the number of persons and households in a room and dwelling respectively in a given geographical area and the relationship between persons in room and households in the dwelling, to give a better understanding of occupancy ratio.

Doxiadis (1975) revealed that Jos and Bukuru had an occupancy ratio of about 3.5 which is compared to the minimum standard of 2.0 persons per room. This could be considered as a high density area. In the rural areas majority of household size according to the Plateau Agricultural Development Programmed (PADP) are 6.8 persons, occupying 2 to 3 rooms against the 3 to 4 persons per room in the urban centers. Furthermore, the National Population census figure for Nigeria in 1991 and 2006 shows the occupancy ratio/rates keep increasing.

Sada & Onibokun (1981) observed that the condition of housing is determined by occupancy ratio and that (congestion) is an indices use to consider the condition of housing in Ibadan. Though his study was carried out in Ibadan city, it would be appropriate to consider occupancy rates in rural dwellings. The occupancy ratio/rate is related to overcrowding when the population is used in measuring housing condition. Thus, this index is very important in identifying housing density (Number of housing units per land) as observed by (Oyekan, 2006). Based on these it shows a level of acceptance by the inhabitants showing their level of satisfaction.

Sule (1980) attempted to create a relationship between households and dwelling. He maintained that there is a standard occupancy ratio; as in a household of eight (8) persons, and age not considered, should have 2.6 or 3 bedrooms in a standard dwelling unit. The United Nations Organization (UN) has a recommended standard of 2.6 persons per habitable room. This recommendation is still not yet met in Nigeria as most urban centres due to continuous increase in housing need and demand. This could be met in most rural areas and deserted settlements just as the Tin-mining region of the Jos Plateau.

The occupancy rate is defined as the number of occupants per habitable room. The federal ministry of health has accepted 2 persons per habitable room as the optimum beyond this it becomes overcrowded as observed by Umeh (1993). The rate of occupancy either low or high is place

oriented and gives the characteristics of the area, for instance, high occupancy ratio are associated with relatively low income earners and high density residential areas of cities. This is not the reflection in most rural settlements, where the most active population has moved to urban centers, and less population is left making the occupancy ratio low. The region is unique with a combination of both urban and rural settings and an occupancy ratio of 2 persons per habitable room as an average used for analyzing the housing condition in the study region.

The failure of dozen of policy many developing countries has created a gap in both urban and rural areas as could be observed in Nigeria. Furthermore, most of the policies are urban bias and does not place emphasis on the quality of housing and its environment in the rural areas. The peculiarity of the Tin-mining region of Jos Plateau, Nigeria is in the fact that 80-90 % of the settlements are located in the urban areas as a result of the sporadic sprawling developments which are fast engulfing the rural areas, which are basically agrarian, with peasant farmers (Wapwera, Parsa & Egbu, 2011). There are a number of concepts used in the assessment of environmental quality around houses that present the environmental quality within the region is very important as an important aspect of the built environment.

RESEARCH METHODOLOGY

This section gives an explanation about the methodology used for analysis and assesses the environmental quality within the study area considering the environmental quality, the effects/impacts of the tin mining activities on the quality of environment and housing dwelling units as well as the level of satisfaction of the inhabitants within the region. The sampling technique adopted for the selection of the settlements is the purposive sampling. The documents use for this paper were selected using convenience sampling while the population of the ten settlements selected were sampled using clustered sampling as used by Mallo, (2012) where mining clustered exist base on the extent of damage and magnitude of devastation/environmental impact suffered within the environment inhabited around the derelict mines, land, erosion features, gullies and mine ponds amongst others. Fifty (50%) percent was picked and questionnaire administered at random to get the views and opinions of the households, from the ten (10) selected settlements about their environmental conditions and within this areas pictures were obtained after observations. Using a case study approach ten settlements were considered. Yin (2009) observed as a case in which a problem has been identified and in this case environmental damage observed to have happened in the mining communities. This was the basis for the consideration of the settlements and these include; Mazza, Mista Ali, Russo Naraguta, Sabon Gidan Kanar, Tangchol, Topp Rayfield, Gana Ropp, Dorowa, B/ladi Tabwang and Maikatako amongst others.

Denscombe (2007) observed that secondary data were relevant in a study of these nature, based on this report about the previous Tin-miming activities within the region were used, whilst the primary data was from the questionnaire administered 300 to the inhabitants and observation of the regions concerning sanitary practices were also considered. The secondary data was analysis using thematic and content analysis while the primary data from the questionnaire was analysed using analysis of variance Anova (F-ratio) as observed by Pallant (2010). These techniques were adopted at different levels to test for different variables used in measuring environmental quality. The use of tables, charts, among others, to present the analysis graphically, and in pictorial forms were adopted at various points.

RESULTS AND DISCUSSIONS

This paper purports to assess the environmental quality of the mining regions by identifying their sanitary practices and examined the effects and impact of the tin mining activities in the study region with a view to developing best practice guidance. The quality of the environment affects the well-being of its inhabitants as a result, the improvement in the physical environment is an indication of a healthy environment and hence the health of the people living within the environment. Dirty, stinking, unkempt and unattractive physical environment, affects the inhabitants because housing environment and human health are closely knitted. Environmental aesthetics are used as a measure of environmental quality.

The discussion considers the sewage disposal, waste/refuse collections disposal and storm water, drainage as a basis for the assessment of the quality of the environment within the study area. Secondly, examined the effects and impact of the tin mining activities in the study region and thirdly, examine the level of satisfaction of the inhabitants with the environmental quality relating it to the impact/effects of the tin-mining activities in their housing, water, soil and air and base on the results developed best practice guidance.

Sewage Disposal

Sewage is liquid waste containing dissolved and /or suspended solid waste, which is passed out from residences, institutions, and commercial, agricultural, or industrial and establishments. Solids in sewage typically constitute about 1/10 by weight as observed by Anderson (2000). The management of these substances is the process of removing, reconditioning and reused. These substances are no longer wanted in their present location and the presence of these substances has adverse effect on the housing condition. When these substances are seen littering the immediate environment, it affects the environmental quality. This could be seen from figure 1. These two methods were used at different locations depending on the convenient disposal method available. In some cases, sewage is not adequately controlled as observed in figure 1.

From the picture it is clear that sewage disposal is not controlled and this is detrimental to a healthy and aesthetic environment that also affects the quality and value of housing as seen on the plate. Most sewage is disposed on the streets and therefore flows through the streets to drain where available. This can lead to the spread of diseases such as cholera, dysentery, childhood diseases, among others, as found in some of the slum dwellings. In 80% of the settlements within the study area pit latrine is used for disposal of sewage, but not discharge into nearby soils, but rather the immediate streets and thus affecting every aspect of the environment as demonstrated in figure 2.

From figure 2 it is clear that the current sewage disposal method in this region is not accepted by the Environmental Protection Agency. Therefore, efforts need to be put in place to correct this practice, to prevent the advent of an outbreak of diseases that can bring about the death of children and adults as well in the area. Figures 1 and 2 shows an environment to have a low quality base on the poor management of the Sewage Disposal from the houses into the open street which serve as a breeding ground for mosquitoes and other disease causing organisms.

Waste/ Refuse Collection and Disposal

The disposal of waste in over 80% of the settlements considers as case studies indicated that the management of this is a major problem because there is no single place where the collection of waste and refuse from homes is done. It was observed that refuse is disposed haphazardly without any control and even if it looks as if there is any effort to dispose of it is found in several places. The implication is that there is no single organise location of collection of the waste/refuse and eventual disposal as observed in figure 3.

Figure 3 shows a major problem exhibited by 70% of the settlements considered as case studies where heaps of refuse were found piled up in several locations. This means that the respondents live in an unhealthy environment that shows it's highly unkempt, since more than 70% of the refuse are not properly disposed. The Surroundings of houses /buildings are mostly littered this is also confirmed by the studies of Wapwera & Lohor, (2009).

Pollution (air, soil and water quality)

Due to the methods of refuse and sewage disposal in the area, air, water and soil pollutions are common. It is as a result of both the pollution from the disposal of these substances in the area and the previous tin-mining activities resulting in many forms of diseases making it very difficult an accepted environmental quality that is habitable.

Fig. 1: *Sewage disposal from houses into the streets*
Source: Authors Fieldwork, 2012

Fig. 2: *Sewage disposal from houses into the streets*
Source: Authors Fieldwork, 2012

Fig. 3: *Dumping of refuse close to houses/dwellings*
Source: Authors Fieldwork, 2012

Fig. 4: *Sewage/waste/refuse disposal in to mining ponds*
Source: Authors Fieldwork, 2012

Drainage Patterns

Drainage patterns/systems available in a dwelling enhance the sanitary condition that has effects on the housing condition. There are no constructed drainages to carry runoffs from the buildings, then run through the open streets and drain into the nearby ponds. Sewages from buildings directly located on mining ponds and other ground surfaces wastes and water drain directly into the ponds as demonstrated in figure 4.

Figure 4 shows a disposal method that is not healthy, as appreciate channels of liquid disposal is not available. It shows that the environment is not healthy for human habitation as it is clear that the sewage/waste/refuse disposal drainage conditions is not adequate and has a tendency of polluting the environment and makes the area prone to diseases as observed by Onibokun (1990) and the UN (2000). Environmental quality has always been the product of perception, though a number of factors that are components of the physical environment determine it (Wahab and Onibokun, 1990). Considering the quality of the environment within the study area base on its health and aesthetics, sewage disposal methods are not adequate and unhealthy. Sewage disposal from the houses into the streets is poor, as it is not accepted by the Environmental Protection Agency.

Storm water drainages are not available and as such disposal of liquid waste from the dwelling is not properly channelled, as observed from pictures. This generally makes the environmental quality very poor. Environmental quality was determined by the following waste disposal, sewage disposal and pollution. These were categorized under the following conditions very good, good, fair, poor and very poor.

The conclusion was that there is variation in the environmental quality within the region. Thus the other components of the environment, that contribute to the quality of the environment is affected by the availability of facilities, utilities and services. Waste/refuse is usually collected and disposed indiscriminately at the back of the buildings or on undeveloped lands, into the mining ponds. Drainages are not available, and the available ones are not properly cleared at regular intervals. These serve as breeding grounds for mosquitoes, and other insects. This discussion now leads to the consideration of the numerous effects and impacts of tin-mining activities on the environmental quality. The effects/impacts of the Tin mining activities on environmental quality

The results of ionizing radiation carried out on the sample of soils from the locations in different parts of the areas with basalts on the plateau show that the gamma radiation dose rates vary from 0.03-0.058 rem/yr (0.32-058mSv/yr), whilst the dose rate due to alpha and beta radiations is from 0.16- 0.32 rem/yr. The total dose rate from both alpha/beta and gamma radiation from the basalts within the Jos Plateau therefore is between 0.19-0.36 rem/yr. The implication of the results shows that the natural radiation levels in basalts around the Jos area are low, generally below the maximum permissible exposure for the general public. This makes the basalts radiologically safe for use in areas such as building construction as well as domestic uses amongst others with little likelihood that safe radiation levels in such buildings will not be exceeded leading to a fairly good environmental quality.

The alpha and beta, gamma radiation particles when exposures are dangerous radioactive materials when taken into the body via food (WHO, 1993; UNSCEAR, 1992). Other studies by Adiuku-Brown and Ogezi, 2004 reveals that there is a gross significance as it relates to Thorium (Th) and Uranium (U) as radioactive by any given route, a decay of say, uranium -238 series, for example , consist of fourteen steps , eight involving alpha decay and six involving Beta decay. Radium (Ra), Radon (Rn) and Thorium (Th) are among the radionuclides emitted in the process. See table 2

The conclusion drawn by Adiuku-Brown and Ogezi, 2004, was that it is unsafe to use the mill tailings scattered in major locations in residential areas and stream channels to build houses or roast groundnut as they contain radioactive materials and toxic elements. Tailings should be properly disposed of in a carefully sited location earmarked strictly for the purpose. There is the need to carry out extensive public enlightenment on the possible hazards that can accompany the indiscriminate disposal and utilization of tailings and monitor compliance.

Tin-mining activities do not affect the quality of the water, though there are traces of Manganese, iron, and chromium but not significant enough to warrant panic, except for fear of bioaccumulation (Gyang & Ashano, 2010; Adiuku-Brown and Ogezi, 2004). In a related study by Ayanbimpe, Abbah & Ior (2012:99) it was observed that water obtained from about 150 sources within the study area (residential area) has it that the presence of fungi has affected the water sources and that it is significant. The different sources of water are visited by a large number of people for activities ranging from bathing and washing as well as irrigation which eventually are transferred to vegetables. The implication of this is the prevalence of fungal infections.

Environmental quality could be considered based on five level scales to determine the level of quality. Depending on the conditions of the various parts of the built environment which include; very good, good, fair, poor or derelict; using variables that determine the functionality and satisfaction of the facilities, such basic amenities, materials use for the construction of the buildings all contribute to the conditions and quality (Onibokun, 1990; Anderson, 2000; Obateru, 2004; Wapwera, 2008; 2010) (see Table 3)

From other research conducted, houses/structures were built on polluted lands; soils with contaminants were used as building materials while water containing such contaminants is used for construction, domestic purpose and sanitation. The air in most of the houses has dust that contains these contaminants (indoor air fungi). More than 75% of respondents had complaints of respiratory systems, frequent headache, eye irritation and skin rash. 61 % of the homes showed dampness of the indoor environment, with more than 50% of the settlements not within the planned areas. 60% of the houses lack proper drainages, toilets and waste disposal facilities and 43% of the houses were old and some dilapidated. See table 4

The analysis in tables 3 & 4 shows the extent of environmental pollution and its impact on the health of local residents. It is important to assert that half of the households surveyed fall outside what is termed as planned area. This has further implications as it demonstrates the ineffectiveness of the planning system and lack of environmental protection. The Jos metropolis and local government authorities seem unable to do anything about the environmental hazard. This could be attributed to inadequate resource availability such as finance, legislative and institutional capacity in terms of planning development and control. In the area of planning, the local governments in the Tin-mining region should have urban and regional planning departments, create and monitor developments, as well as make funds available for development control at that level as observed in the 1992 URP law, this is not available.

This next section examines Level of satisfaction by the inhabitants on the quality of the environment and the impact/effects of tin-mining activities in the study area which contributes to the wellbeing and quality of life in the area.

Level of satisfaction of the inhabitants

The perception of the inhabitants of any given area is dependent on some factors that best relates to their ability to provide and make available at every point for the use of the people. Base on the rating and advance research classification can put into Good, fair and poor as it relates to the availability of the facility in a given area. Thus, from this study the following was obtained as the responsiveness of the inhabitants in the study area concerning some of the toilet facilities, such as Pit toilet, water closet, and the open bushes. See figures 5, 6 and 7

Most a times the issue of perception is more dependent on the exposure of the inhabitant to whatever facility is at their disposal in relation to the facility in question thus base on the availability of a specific type of toilet at their disposal. From this study is clear that the most commonly used types of toilets are pit toilets, water closet and the open bushes depending on the availability in the settlements selected.

Analysis of variance F-ratio (ANOVA F-ratio) was used to test this hypothesis. The calculated F-ratio was 86.481 and the critical F-ratio values at 0.05 and 0.01 are 3.70 and 6.50 respectively. Therefore, since the calculated F-ratio was greater than critical values. The H0 was rejected.

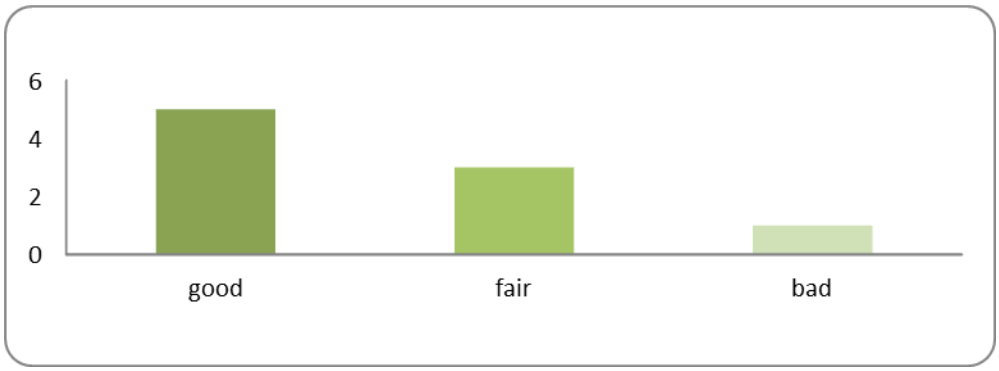

Fig 5: Perception for Pit toilet by respondents
Source: Wapwera, 2008

Fig 6: Perception for water closet by respondents
Source: Wapwera, 2008

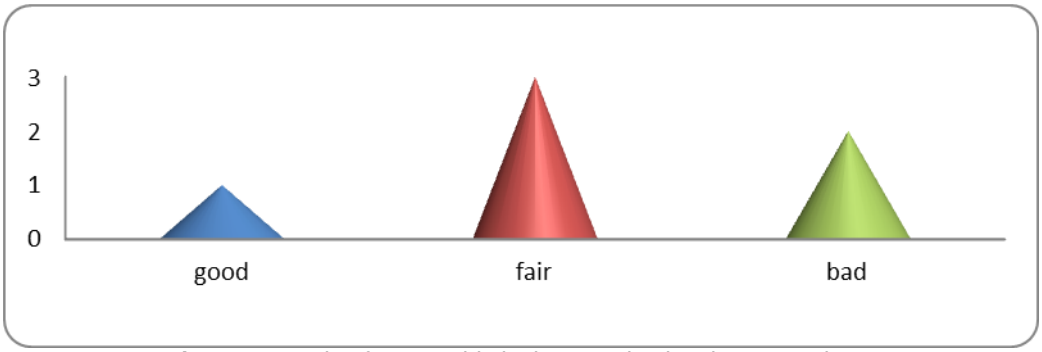

Fig. 7: perception from outside in the open bushes by respondents
Source: Wapwera, 2008

The conclusion was that there is a relationship between environmental quality and housing conditions within the study region. Housing is a major component of the environment, it therefore means that if the quality of the environment is affected, it is because of the condition of its components. The condition of the housing is dependent on the state and availability of facilities in the dwellings.

From the study three (3) types of toilets were identified this were water closet, pit latrine and the nearest bushes. The availability of these facilities determined to a large extent the quality of housing, but the adequacy of the water closet is affected by the inadequacy of water supply, yet still the evacuation or flushing can be done manually to bring about sanity and a healthy environment. But the pit toilets are more because that is what is readily available and it is most adequate since it is the most affordable considering their socioeconomic status see table 1. Though some members of the communities in the study region use to pass their waste in the open bushes it is not a good practice as it encourages easy spread of diseases, and other epidemic in and around the region. The condition of housing is dependent on the adequacy and availability of this facility, (Toilet). This determines as well the level of satisfaction of the inhabitants about their houses.

CONCLUSION

This paper seeks to assess the environmental quality of the mining regions by identifying their sanitary practices and the level of satisfaction of the inhabitants of the region. The analysis of data collected from the ten (10) selected settlements revealed that the environmental quality of the region is bad. The implication of the environmental quality

using the Jos Plateau Tin Mining Region (JPTMR) shows that the environmental sanitation present problems such as indiscriminate disposal of sewage, poor public convenience and poor general cleanliness and hygiene amongst others. This is not completely disentangled from the effects /impact on housing, water, air and soil experienced as a result of the presence of heavy metals and radioactive substances at varying levels. With all these the inhabitants were moderately satisfied with the availability of facilities, utilities and services even though not adequately available.

The problems of this region are not independent of the components of the region. These conditions, if allowed to continue will affect the well-being of the inhabitants of the region, (Tin Mining Region). For this the regional integrated management, strategies should be adopted as it addresses the physical, social, economic and environmental characteristic, of poor housing condition, to ensure the growth and development of the region. Based on these, the planning implication is strongly tie to the absence of a master plan which goes a long way in addressing the problems evident in the region if properly implemented over the period under review.

RECOMMENDATION

Based on the findings from the objectives the following recommendations were made;

- There should be enforcement of building regulations and environmental sanitation laws by the appropriate authorities
- Households should provide refuse bins and collection points should be designated as already done in the city of Jos
- Physical improvement of settlements should be through a series of environmental improvement programmes that could clear the region of the presence of heavy metals and radioactive substances at varying levels
- State and Local Government areas should be committed to providing the minimum infrastructural services that are needed to ensure decent living standards. These include water reticulation, waterborne, sewerage, electricity, storm water drains and tarred public transport routes.
- However, the provision of these services is very costly, but public awareness and education should be encouraged.

REFERENCES

Abbott, J. (2002). A National Profile NEST. Publication 1991, Pp 34-42.

Abdullakeem , O and Raheem, M (2013). Ental and Health impact of mining in Abara and Tungur community of Anka LGA of Zamfara state. Being a paper presented during the conference.

Adedayo, A (2000). Environmental sanitation and waste management policies at the local level in Nigeria. Geo-studies forum. Vol 1 no. 1 and 2. 2000.

Alexander, M.J (1985). An Historical Introduction to the Reclamation of Mined Land on the Jos Plateau.Jos Plateau Environmental Resources Development Programme. Interim Report No. 4 November, 1985.

Anderson, L.T (2000).Planning the Built Environment. Planners press American planning Association Washington DC.

Adiuku-Brown, M.E (2004). Effects of cassiterite mining and associated By-Products on the environment: A study of some trace elements in Jos Plateau and Zurak Mining Districts,North central Nigeria. PhD thesis submitted to the University of Jos, Jos Nigeria.

Adiuku-Brown, M.E & Ogezi, A.E (2004). The Utilisation of Mill Tailings on Jos Plateau: A need to excercise some restraint. African Journal of Natural science. Vol. 7, 2004.

Agbola,T and Kassim,F. (2007). Conceptual and Theoritical issues in Housing. In: Agbola, T. Egunjobi, L. and Olatubara C. Housing development and management: A book of readings.Ibadan: Department of Urban and Regional Planning, Faculty of the social Sciences, University of Ibadan, P15-69.

Agbola, T. Nwokoro,I. and Kassim,F. (2007). Housing and Health In: Agbola, T. Egunjobi, L. and Olatubara C. Housing development and management: A book of readings. . Ibadan: Department of Urban and Regional Planning, Faculty of the social Sciences, University of Ibadan, P499-537.

Agbola, T., Egunjobi, L & Olatubara, C.O. (2007). Housing Development and Management: Ibadan, Malijoe softprint. Ibadan. 93-104

Aguigwo, E. N. (1997). "The Characteristics and Viability of Informal Mining on the Jos Plateau". Ph.D. Thesis. University of Jos: Jos, Nigeria.

Alshachi, Y. (2009). Risk Assessment at Abandone tin mail in Sungai Lambing, Pahang, Malaysia. Analysis of Informal Settlement Upgrading and Critique of Existing Methodological Approaches. Habitat International. 26, 303-315.

Alshaebi, F.Y. et al., 2009. Risk Assessment at Abandoned Tin Mine In Sungai Lembing, Pahang, Malaysia. Electronic Journal of Geotechnical Engineering, Volume 14 (Bundle D), pp. 1 - 9.

Ajayi I.R. (2008). An evaluation of the equivalent dose due to natural radioactivity in the soil round the consolidated Tin mine in Baukuru-Jos, plateau state of Nigeria. Iran. J. Radiat. Res., 2008; 5 (4): 203-206.

Ajaegbu H.I (1986). Mining and land degradation on the jos plateau. Paper presented to the 24th annual conference of Nigeria geographical association –Kano.

Anderson, L. (2000). Planning the Built Environment. Planners press. American Planning Association ISBN: 1884829430 Washington DC, Chicago

Ayanbimpe, G., Wapwera, S., and Kuchin,D., (2010). Indoor air mycoflora of residential dwellings in Jos metropolis. Journal of African Health sciences. Vol. 10, No.2, (June, 2010), pp 172-176

Ayanbimpe, G.M, Wapwera, S.D, and Okolo,M.O, (2011).Relationship between Fungal contamination of Indoor air and Health problems of some residents in Jos dwellings in Jos metropolis.

Ayanbimpe, G.M., Abbah, V.E. & Ior, C.A (2012). Yeasts and Yeast-like fungal contaminants of water used for domestic purposes in Jos, Nigeria. Microbiology research.Vol.3:e24.pp 99-102. Doi:10.4081/mr.2012.e24.

Barry, M. (2010).Lead poisoning kills hundreds of children in Nigeria Vanguard newspaper 19 October (2010).

Beretka, J & Mathew P.J. (1985). Natural radioactivity of Australian building materials, waste and byproducts, Health Physics. 48, 87-95.

Benevento M., Mascaro I., Corsini F., Lattanzi P., Parrini P., & Tanelli G. (1997). Mine waste Dumps and Heavy metal pollution in abandoned mining district of Boccheggiano south Tuscary, Italy. Environmental Geology 30:238-243.

Bruntland, G (ed) (1987). Our Common Future: The World Commission on Environment

and Development, Oxford: Oxford University Press.
Butt, N.(2010). Environment, mining and the lesser Developed countries, spinger-JournalArticle.
Dorman M.J (1978).Problems of Soil Erosion On The Jos Plateau In Ajaegbu And Planning In Nigeria. Proceedings of the 21st Annual General Conference of Nigerian Geographers Association Held in University of Jos April, 1978.
Davou, D.D and Odeyemi, I, B (2013). Environmental impacts of mining on the Jos Plateau, Nigeria. Being a paper presented during the Conference 40 Years of the GSAf (1973-2013): Earth Sciences Solutions to African Development Challenges. Session 5.3. Environmental and Health Impacts of Mining in Africa (Special Session under the Auspices of IGCP/SIDA Projects 594 and 606). January 8-14, 2013- 08-22 at the Millennium Hall Addis Ababa, Ethiopia.
Denscombe, M. (2007). The Good Research Guide for small-scale social research Projects. New York: McGraw-Hill Press.
Douglas, I. (1996). The impact of Land-use changes, especially logging, shifting cultivation, mining and urbanization on sediment yields in humid tropical Southeast Asia: A review with special reference to Borneo. Global Regional perspectives proceedings of the Exeter symposium, July 1996 pub. No. 236: pg 464-71.
Doxiadis Associates International (1975). Jos-Bukuru Metropolitan Master Plan. 1975-2000. Maxlock Consultants for Kaduna master plan, 1917, 1967, 2017
Dung-Gwom J. Y, Hirse,S. O. & Pwat, S. P. (2008). Four year strategic plan for Urban development and housing in plateau state (2008-2011).
Eziashi A.C (2000). Harnessing the Mine Ponds of Plateau for Rural Development. Journal of environmental sciences. Vol:8 no.1
Forstner, U & Wittmann, G.T.W (1983). Metal Pollution in the Aquatic Environment 2nd ed. Springer-verley, Berlin 486p.
Fayankin F.D (1984). Housing Quality in Nasarawa Gwom Area of Jos. Unpublished B. Sc Project in the Department of Geography and Planning, University Of Jos.
Gyang J.D and Ashano E.C (2010). Effects of Mining on Water Quality and the Environment: A Case Study of Parts of the Jos Plateau, North Central Nigeria". Pacific Journal of Science and Technology.11(1):631-639.
Hammond .R, MC. Cullagh (1978). Quantitative Technique in Geography. Glerido Press Oxford.
Hardoy E.J (1992). Environmental Problems of 3rd world cities.
Howard W J (1975). Central Nigeria Project: Rehabilitation of Tin Mining Land on the Jos Plateau L.R.D Miscellaneous report no.213, 1975.
Kitula, A. (2006). The environment and socio-economic impacts of mining on local Livelihoods in Tanzania: A case study of Geita District. Journal of Clearner Production 14 (2006) 405-414.
Jiriko K.G (2001). Aspects and Tropical Issues in Urban and Regional Planning Practices Vol. 1
Leblanc. M., Morales J.A., Borrego J. & Elbaz. Poilichet E. (2000). 4500 Year-old mining pollution in South Western Spain: Long term implication for modern mining pollution, econ. Geol. 95: 655-662.
Lee C., Chon H. & Jung M. (2001). Heavy metals contamination in the Vicinity of the Daduk, Au-Ag-Pb-Zn mine in Korea. Apply Geochem 6: 1377-1386.
Mabogunje, A. L. (1978). Environmental challenges of sub-saharan Africa, centre for advanced social sciences. Centre for advanced social sciences. Monograph.
Macleod, W. N., Turner, D.C. and Wright, E.P. (1971). The Geology of Jos Plateau. Bulletin Geological Survey of Nigeria. 32 Vol1., pp. 12-47 pp.
Mallo, M. and Anigbogu, N (2009). Housing Quality Between Residential Neigbourhoods In Jos, Nigeria. The paper was presented at International Sociological Association (ISA) Conference Glagow Caledonian University.
Mallo, J.O (2012). The Socio-Economic Impact Of Artisanal Mining In Kuru (Naraguta Sheet 168) Plateau State, North Central Nigeria. Continental J. Engineering Sciences 7 (3): 27 – 32, 2012 ISSN: 2141 – 4068. 2012 http://www.wiloludjournal.com Printed in Nigeria.
Marques, M. J., E. Martinez-Conde, J. V. Rovira, and S. Ordonez, (2001). Heavy metals pollution of aquatic ecosystems in the vicinity of a recently closed underground lead-zinc mine Basque Country, Spain. Environment Geology 40:1125–1137.
Mbaya, R. P (2013). Land Degradation Due to Mining: The Gunda Scenario. International Journal of Geography and Geology journal homepage: http://aessweb.com/journal-detail.php?id=5011.
Mendie, A. (2009). Nature & Extent of the dynamics which the Tin Mining industry has brought to Jos Plateau Tin Mining region. Unpublished Ph.D. thesis, University of Jos.
Mhlongo, S, E, Amponsah-Dacosta, F and Mphephu, F (2013). In search of appropriate rehabilitation strategies for abandoned Nyala Magnesite Mine, Limpopo Province of South Africa. Being a paper presented during the Conference 40 Years of the GSAf (1973-2013): Earth Sciences Solutions to African Development Challenges.
Session 5.3. Environmental and Health Impacts of Mining in Africa (Special Session under the Auspices of IGCP/SIDA Projects 594 and 606). January 8-14, 2013- 08-22 at the Millennium Hall Addis Ababa, Ethiopia.
Mohsen, N., Ismail, B., Pauzi, A (2005). Assessment of Natural radioactivity in water and sediment from among (Tin tailing) process pounds. Proceeding of the 18th Malaysian Analytical chemistry symposium SKAM-18 UTM, Johor Bahru, Malaysia, p.293-304.
Mohsen, N., Ismail, B., & Pauzi, A (2007). Gamma Hazards and Risk Associated With Norm in Sediment Amang processing recycling Ponds. The Malaysian Journal of Analytical sciences, Vol. 11 . No. 1(2007):314-323.
Mudroch, Stottmeist, Kennedy.Klapper (2005). Remediation of Abundant Surface Coal Mining Sites. Nigerian Threatened Environment A National Profile NEST. Publication 1991, Pp 34-42.
Obateru, R.I (2004). Land Subdivision Basics. Penthouse Publications (Nigeria).
Omuta, G.E and Onokerhoraye, A.G (1986). Regional Development Planning. The Geography and planning series of study notes.
Onibokun, p. (1990). Urban Housing In Nigeria (Niser Pp 89,101-361. (Nigeria publishers) NISER Limited,Ibadan Nigeria
Olawuyi, A and Mudashir, R (2013). Environmental and health impact of mining in Abara and Tungar ommunity of Anka Local Governement Area of Zamfara State, Nigeria. Being a paper presented during the Conference 40 Years of the GSAf (1973-2013): Earth Sciences Solutions to African Development Challenges. Session 5.3. Environmental and Health Impacts of Mining in Africa (Special Session under the Auspices of IGCP/SIDA Projects 594 and 606). January 8-14, 2013-08-22 at the Millennium Hall Addis Ababa, Ethiopia.
Ohiafeode Y.G (2003). Regional Plan For Jos Plateau Mining Region Plateau State Part One. (Unpublished) M.Sc region plan in urban and region planning university of Jos.
Olaseni A.M (2006). Rural Development Planning In Nigeria. Environmental studies series. Concept Publications Limited.
Onibokun, P (1990).Urban Housing In Nigeria (Niser Pp 89,101-361.
Onibokun, P (1985). Housing in Nigeria (a book of selected reading,) Niser, Ibadan.
Pallant, J. (2010). SPSS Survival Manual 4th Edition. A step by step guide to data analysis using the SPSS program. England Berkshire: Open University Press McGraw-Hill House.
RICS Report, (2006). Education trust annual review of the RICS Education Trust. www.rics.org

Roussel C., Neel C., & Bril H. (2000). Minerals controlling arsenic and lead solubility in an abandoned gold mine tailings. The science of the total environment 263: 209-219.

Rydin,Y.(2011).The purpose of planning creating sustainable towns and cities. The policy

press, university of Bristol(2011) Fourth floor beacon House Queens Road BristolBS8 1QU. UK.

Sada, P. O. & Onibokun, J.S. (1981). Urbanisation processes and Problems In Nigeria I.U P., Ibadan.

Sawyer, C.N. and McCarthy, P.I. (1970). Chemistry for Sanitary Engineers, 2nd Edition,
McGraw Hill: New York, NY. 518.

Schwab P., Zhu D., & Banks M.K. (2007). Heavy metal leaching from mine tailing as affected by organic amendments. Bio resource technology 98:2935-2941.

Shapiro, J (1972). Practical aspects of the use of radionuclides (Part V). In radiation protection Cambridge, MA, Havard University Press.

Shat, T.A (2005). Housing Conditions in Kakuri District, Kaduna (Unpublished) M.Sc. Dissertation. Environmental Resources Planning (ERP), Department of Geography and Planning, University of Jos.

Sharman, Harri D, & Reddy, Krishna R. (2004). Geo-environmental Engineering: Site remediation, Waste
containment and emerging waste management technology, John wily & Sons, inc. Hoboken, New Jersey.

Solomon, A. O., Ike, E. E., Ashano, E. C. and Jwanbot, D. N. (2002). Natural background radiation characteristics of basalts on the Jos Plateau and the radiological implication of the use of the rock for house construction. African Journal of Natural
Sciences Vol. 5. 2002,

Sule, R.A (1993). The Environment And Housing in Taylor R W(Ed) Urban Development In Nigeria Planning
Housing And Land Policy. Averbury, USA. The case of Lagos, paper presented at a seminar on migration in
Nigeria.Ile-Ife, May 5th -8th 1975. The Macmillan press Ltd.

Turner D. C. (1976). Structure and petrology of the Younger Granite Ring Complexes of

Umeh, C.I. (1984). Trends In Rural Housing In Taylor R w (Ed) urban development in Nigeria planning, Housing And Policy Averbury New Jersey Pp 107-214.

United Nations Scientific Committee on Effects of Atomic Radiation (1988). Exposure from
natural sources of radiation. UNCEAR Report 121-167.

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)
(1998) "Sources, effects and risks of Ionizing Radiation", United Nations, New York.

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR),

(1993) Sources, effects and risks of Ionizing Radiation. United Nations, New York.

World Health Organisation(Europe) (2007). Programmes And Projects, Housing and health- housing topics.

William .F. (2004). Joint Center for Housing Studies .Harvard University, state of the nations housing.

Woodford .J (1978). Patterns of Settlement in Southern Zaria. Savanna, Vol.3 No.1.June 1978.

Wade, J.W and Ufodike, E.B.C (_). Investment prospect of fish in the Jos Plateau, Nigeria. A publication of the Applied Hydrbiology and fisheries Unit Department of Zoology, Uinversity of Jos, Nigeria.

Wahab.K, Adeokun.L, & Onibokun.P (1990).Urban Housing in Nigeria Pp 59-61. NISER

Wapwera, S.D (2008) Housing conditions in selected Tin mining regions of Jos plateau. Unpublished M.Sc. thesis.

Wapwera, S.D (2010) Impact of tin mining activities on Housing system in the Tin mining regions of Jos plateau. Unpublished NITP thesis.

Wapwera, S.D, Parsa, A.G & Egbu, C.O (2011). Financing low income housing in Nigeria. Journal of Financial Management of Property and Construction.Vol. 16 No. 3,pp. 283- 301. DOI 10.1108/13664381111179242

Wapwera, S.D, Egbu, C.O, Parsa, A.G & Ayanbimpe, G.M (2015). Abandoned Mine, Potential Home for the People: A Case Study of Jos Plateau Tin-mining Region (JPTMR). Journal of Construction, Environment and Architecture. USA.

Wapwera,S.D (2014). Spatial Planning Framework for Urban Development and Management in Jos Metropolis
Nigeria (Unpublished PhD thesis submitted to the University of Salford, Manchester United Kingdom.

World Health Organization (1993). Working group committee report. WHO Document ICP /
CEH 109 (S). 21.

World Health Organization (1993). Guidelines for drinking water quality. 2nd Ed. Vol 1. Recommendation pp.114, 112.

Yin, R. (2009). Case study research: Design and method. Applied social research methods series. California: SAGE.

Yinusa M.I. (1985). Rural Housing in Nigeria, Concepts, Problems and Functional Approach. NITP journal Vol. IV &V, Pp59-71.