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Effect of Small Scale Mining on the Environment of Tarkwa-Nsuaem Municipality of Ghana

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Abstract
The study examined the effects of the activities of Small Scale Mining on the environment in the Tarkwa-Nsuaem Municipality. A simple random sampling technique was used to select 123 small scale gold miners in the municipality. The study also ascertained why people engage in SSM and determined the effect of SSM on the environment.
The study identified poverty and unemployment as the main reasons why people engaged in small scale mining. Also the study revealed that, small scale miners suffered from respiratory and skin diseases as a result of their mining activities. Majority of the respondents also accepted the fact that their activities had an adverse effect on the environment, however very few of these miners took steps to reduce the negative impact of their activities on the environment.
The study concluded that small scale mining leads to environmental degradation and very little effort is made by miners to reduce the effect of their activities on the environment. The study therefore recommends that small scale miners should be given some education on how to reduce the effects of their activities on the environment.
Keywords: environment, respiratory, degradation, small scale mining, poverty, unemployment

1.0 Introduction

According to Hilson (2001), mineral production from small scale mining (SSM) accounts for about one-sixth of global mineral output and in Ghana since its legalization had generated significant revenues to the economy. The minerals mined by the small-scale miners also generate a significant foreign exchange for the country. For instance gold production in 2010 by small-scale miners was 767,196 ounces, and this represented 23 percent of total gold production in Ghana whiles diamond production represented 100% of total diamond production (Koomson, 2010). There has also been improvement in the contribution of SSM to the country's revenue from gold in 2011 and 2012. Revenue from gold increased from $4,631 million in 2011 to $5,306 million in 2012. During the same period SSM contribution was $397million and $536million out of the total revenue from gold in 2011 and 2012 respectively (Ghana Chamber of Mines).
In Ghana, the mining subsector of the Ministry of Lands and Natural Resources is the body that supervises the mining industry. The environmental aspects of mining are directly regulated by the Environmental Protection Agency Council Act (EPAC act of 1974) and Mining Regulations. According to Acquah (1995) the Minerals and Mining Law of 1986 made provision for environmental protection and pollution prevention. Under the 1996 Minerals and Mining Law the Minister of Lands and Natural Resources is responsible for regulations put in place to restrict mining activities near water bodies, prevent water pollution among others. These are basically meant to prevent permanent environmental destruction through mining and to encourage sound stewardship (Vormawor & Awuku-Apaw, 1996). The regulation has three parts including guidelines for exploration, mining, processing and decommissioning guidelines for preparation of an Environmental Impact Assessment (EIA) for new projects and guidelines for preparing an Environmental Action Plan (EAP) for existing projects. Both EIA's and EAP's are made available to the public. The EAP has to be submitted for approval by the Environmental Protection Council (EPC) every two years.
The operations of small-scale miners are also regulated by the Minerals and Mining Act of 2006. But most of these miners operate illegally. According to the act, anybody licensed to carry out small scale mining may win, mine and produce minerals by an effective method and shall observe good mining practices, health and safety rules and observes rules regarding the protection of the environment during the mining operations. But according to Hilson (2001), most of these have been violated especially in the case where most of the miners are not licensed.
Generally, SSMs are poverty motivated and situated mostly in the rural areas of Ghana. The miners are basically unskilled and earn little from the activity since most of them are simply labourers. Furthermore, a greater percentage of these miners are operating illegally and therefore they do not benefit from any training to improve their businesses unlike their registered and legalized counterparts. This also means a lot of revenue is lost by government since most small-scale miners are unregistered.
The government of Ghana has over the years put in place measures to encourage small-scale miners to mine in an economically and environmentally sustainable way. Some of these measures include siting and equipping districts offices of the Minerals Commission close to areas designated for mining to ensure the provision of

efficient extension services, identifying and carrying out limited geological investigation on suitable areas for SSM and blocking these areas out to small-scale miners, establishment of a fund worth about GH¢700,000 for organized SSM groups to access, and limiting the negative effects of SSM through education and enforcement of rules and regulations.

Despite the benefits of SSM to the Ghanaian economy and the interventions by government to encourage environmentally friendly mining, the sector continues to pose as a great danger to the environment and the society. The major negative effects SSM has on the environment include mercury pollution from the processing of gold and land degradation. According to Hilson (2001) the use of mercury for processing gold is heavily depended upon because it is less expensive, reliable and portable operation for concentrating and extracting gold from low-grade ores.

According to Koomson (2011); not only has the operations of the small-scale miners affected the environment, it has also led to other social vices including child labour, increases in truancy by school children which may even lead to dropping-out from school, alcohol use, drug abuse and prostitution. The sector if remain uncheck will cost the nation more than half of the revenue generated from it in terms of treating water, planting trees, treating diseases, etc. In term of the human resources and loss of some plant and animal species can never be recovered.

The general objective of this paper is to assess the effects of small scale mining on the environment of Tarkwa-Nsuaem Municipality of Ghana

2.0 Methodology

2.1 Study Area

Tarkwa Nsuaem Municipal assembly is a district in the Western Region of Ghana located between Latitude 400'N and 500 40'N and Longitudes 10 45' W and 20 10'W. It is bounded to the north of the district by the Wassa Amenfi East District, the south by the Ahanta West District, the West by the Nzema East Municipal assembly and the East by Mpohor Wassa East. The Municipality has a total land area of 2354 square kilometres.

The Municipality had a total population of 232,699 in the published 2000 population census at a growth rate of 2.97 (Ghana Statistical Service, 2013). The projected figure for 2006 was 266,857 which were made up of 134,941 males and 130,916 females at a growth rate of 3.0 which was higher than the national figure of 2.7. In 2005, the male to female ratio was 103:100. The larger population of the males is due to the immigration of males into the district in search for employment in the many mining and auxiliary companies operating in the district.

There are several mining companies that are located within the district together with mining support services and industrial laboratories. Some of these mining companies are Goldfields Ghana Limited, Aboso Goldfields Limited, Ghana Manganese Company Limited, Ghana Australian Goldfields, New Century Mines, Prestea Sankofa Gold Limited and Bogoso Gold Limited. Mining contribute immensely to the vibrant nature of the local economy. The proliferation of "galamsey" activities attests to the fact that there exist mineral rich rocks. These "galamsey" activities although very detrimental to the environment, especially land, water (pollution) amongst others, it contributes in diverse ways to the micro-economy. The Municipality Assembly has eleven decentralised departments which include the Small Scale Mining Department under the Mineral Commission. This Department is in charge of small scale mining in the municipal.

2.2 Research Design

This study used survey design to investigate the impact of small-scale mining on the environment at Tarkwa-Nsuaem Municipality in the Western Region of Ghana. The major advantage of this survey approach is that it can be used for descriptive purposes and allows for direct contact between the researcher and the respondents in the process of collecting data for the study (Singleton et al., 1993). Moreover, this approach can also be used to obtain detailed and precise information about different groups of people.

Nevertheless, according to Singleton *et al*. (1993) one disadvantage of this form of study design as compared to other designs, relates to the possibility of respondents not giving out true nature of events or state of affairs. This is owing to the fact that in survey design the researcher depends on reports of behaviour rather than observation of respondent's behaviour. Hence there exist measurement error produced by respondents' lack of truthfulness, misunderstanding of questions, and inability to recall past event accurately and by the instability of their opinions and attitudes.

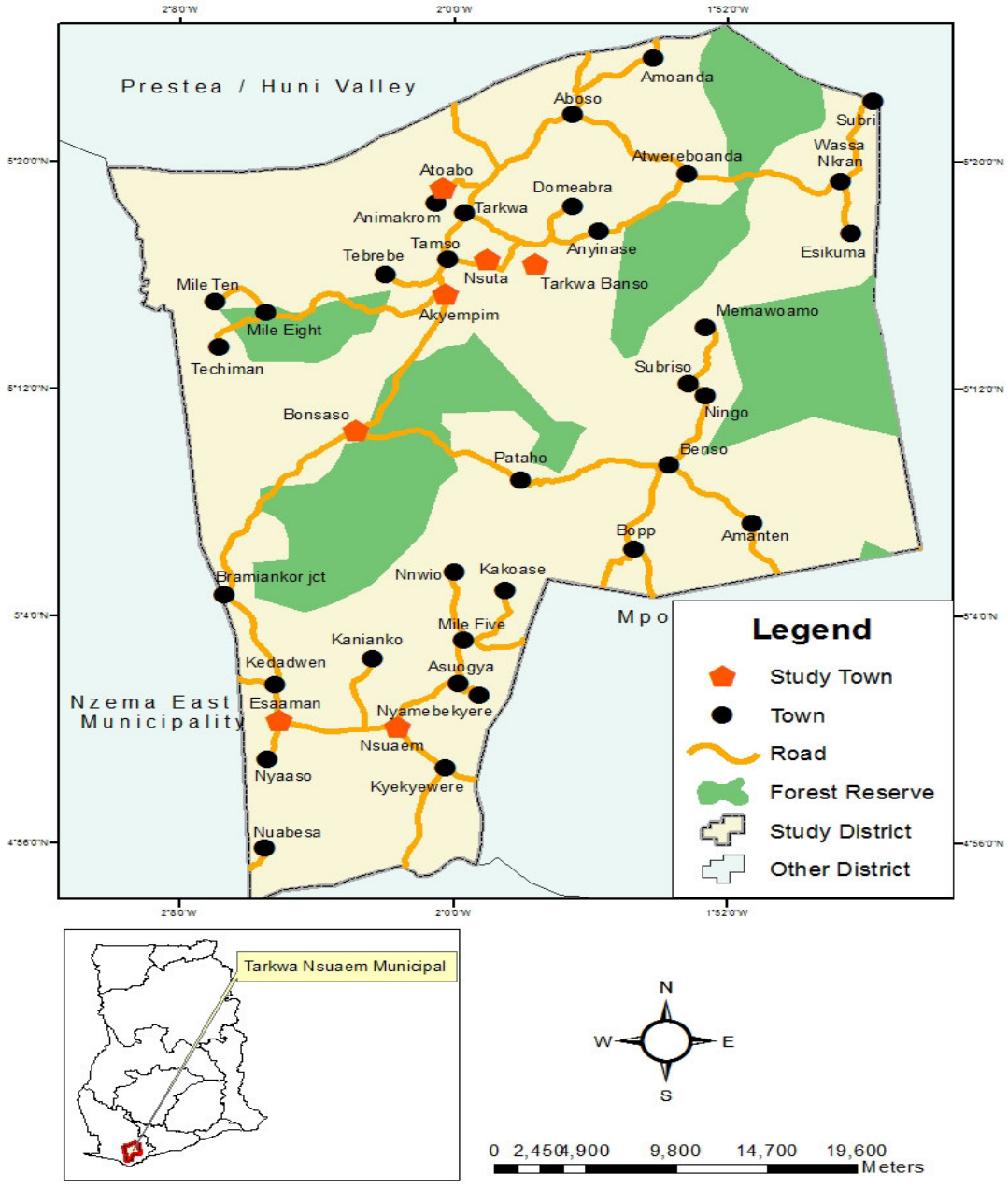
2.3 Population

The target population for the study comprises small-scale miners in the Tarkwa-Nsuaem Municipality. According to the Small Scale Mining Department at the municipality, the registered small-scale miners number 256.

2.4 Sample Size Determination and Sampling Procedure

According to the table, a population of about 300 has a sample size of 123 using a margin of error of 0.3 and an alpha level of 0.1. Therefore the sample size for this study is 123 small-scale miners given a population of 256.

To obtain the actual respondents for the study, the list of the small-scale miners was obtained from the Small Scale Mining Department of the municipality. This formed the sample frame for the study. A simple random sampling method was used in selecting the sample size. The sample frame was numbered and pieces of papers of equal size were also numbered from one (1) to 256 and further put into a bowl. The papers in the bowl were shuffled and picked one at a time until all 123 respondents were obtained. The respondents corresponding to the numbers selected were contacted and interviewed. Those who were unwilling to give information were replaced by selecting new respondents from the bowl. The data set was collected from; Tarkwa Banso, Bonsaso, Nsuaem, Akyempim, Atoabo, Essaman and Benso. This was also randomly selected out of eighteen communities. This is because even though small scale mining is pronounced at several other locations, their activities are more prevalent in the areas mentioned and their effect on the environment will be of greater consequence in these communities than the others.



Source: GIS/Remote Sensing Unit, Department of Geography and Regional Planning, UCC, 2012.

The study used the registered small scale miners because it was difficult getting access to illegal small scale miners. Most of these illegal miners are usually unwilling to disclose their activities to the general public due to the fear of been arrested by the joint Military and Police patrol teams. More so, unregistered small scale miners

become very hostile when they see strange people among them. Hence the study only use registered small scale miners who were readily available for the study.

2.5 Sources of Data

The study principally used primary data obtained from the field for the analysis of the study.

2.6 Research Instrument

The main instrument for the survey was the formal interview schedule. The instrument used in the survey covered a wide range of topics including, the demographic characteristics, health conditions, forms and methods of mining, knowledge on the impact of mining activities on the environment, etc. All the instruments were administered through face-to face interviews. The instrument was chosen due to the fact that it can be used to generate qualitative data from respondents.

2.7 Data Analysis

The analysis and presentation would be done using correlation and descriptive statistics: percentages and frequency distributions generated through SPSS software.

3.0 Results and Discussion

3.1 Socio-Economics Characteristics of Respondents

The socio-economic characteristics of the respondents in this study are presented in this section. Table 1 depicts the gender distribution of the respondents. Most of the respondents were males (72.4%). Even though the proportion of male to female respondents is 72.4 percent to 27.6 percent, one expects this disparity to even be wider as mining is perceived to be a job for men. This is consistent with Hilson (2001) description of the small scale mining sector. Hilson (2001) argues that the small scale mining sector is labour intensive which involves the direct application of human efforts through digging, breaking panning among others. This will therefore require more masculine efforts than that of a female. The result is also consistent with the explanations of Aryee *et al.* (2003) that small scale mining mainly uses the manual method which requires a lot of human efforts. Hence one can conclude that Small Scale Mining Activities in the Takwa-Nsuaem Municipality is a male dominated occupation with relatively small female participation. The situation is also so as females are normally involved in carrying the mini 'loads' for washing or to the washing board.

Again Table 1 reveals that most (79.7%) of the respondents are between the ages of 10 and 40 which is the youthful age in the life of mankind. This is even more evident in the most active age group in the youthful age group, representing 36.6 percent. The lower percentage (20.3%) of respondents above age 40 means that small scale mining is a job for the youth as it involves the use of a lot of energy. This further provides evidence to the fact that, small scale mining requires strong and energetic people. This is clearly in line with Hilson's (2001) description of small scale mining activity as a labour intensive work.

As indicated in Table 1, out of the total of 123 who responded to the questionnaire, 14.6 percent had no formal education, 70.7 percent basic school education and 14.6 percent senior high school education. The low level of formal education of respondents is an indication that small scale gold mining does not require much of a formal education before one can partake in their operations; rather what one needs is the requisite skills and the technical know-how in small scale gold mining. This is consistent with the exposition provided by Hilson (2001). Hilson noted that, small scale mining activities usually lacks technical and management skills. This is also supported by the arguments of Aryee *et al.* (2003).

The majority (66.7%) of the respondents are migrants from far and near who have come to seek greener pastures or to better their lot. This is consistent with the findings of Nyame, Grant & Yakovleva (2009) study on mining and migration patterns in Ghana in which it is found that non-indigenes participated most in small scale mining activities. This situation is likely increase the adverse effect of small scale mining activity on the environment. Thus, immigrant miners may be less concerned about the environmental effects of the use of mercury.

The number of years in the small scale mining can be used as a proxy for experience in the mining business. As revealed in table 1 most (75.7%) of the respondents have not been or do not stay in the small scale mining for long. This might be due to fact that most people will not have the strength and energy to be in the industry till they attain the normal retired age of 60 years. This reiterates the point that most people go into the business to get some capital to engage in a more sustainable business other than the small scale gold mining. This is likely to have adverse effect on the environment. Because small scale miners are likely to gain more experience on how to dispose or deal with harmful chemicals in their operations so as to reduce the environmental effect. However, since majority of these miners do not stay long in this activity, there are always new entrants in the small scale mining business and this means constant pollution of the environment.

Table 1: Socio-economic characteristics of respondents

Variable	Frequency	Percentage
Gender		
Male	89	72.4
female	34	27.6
Age		
10-20	17	13.8
21-30	45	36.6
31-40	36	29.3
41-50	19	15.4
51-60	6	4.9
Educational level		
No formal education	18	14.6
Basic	87	70.7
Secondary	18	14.6
Indigenous status		
Indigene	41	33.3
Non-indigene	82	66.7
Experience in mining (years)		
0-5	67	54.6
6-10	26	21.2
11-15	11	8.9
16-20	8	6.5
21-25	10	8.1
26-30	1	0.8

Source: Field Survey, 2012

3.2 Awareness of the Destruction of the Environment by Small Scale Mining Activities

As indicated in Table 2, the majority (79.7%) of respondents are aware of the destruction of the environment by the operations of small scale gold mining, whiles the minority (20.3%) of the respondents are unaware of the implications of their activities on the environment. Clearly small scale miners are aware of the negative effect of their activities on the environment. This is because activities of these people results in the pollution of our water bodies especially through the use of mercury as their main input of production (MMSD, 2002). More so activities of small scale miners results in the degradation of land. The result also confirms the explanations provided by Iddirisu & Tsikata (1998) that prospective sites for mining are usually stripped bare of vegetation, topsoil and where deep underground mining has occurred, the pits are left exposed and abandoned. Hence, small scale miners who usually undertake this routine to get their gold are aware of the negative effect of their activities on the environment.

Table 2: Awareness of the destruction of the environment by small scale mining

Responses	Frequency	Percentage
Yes	98	79.7
No	25	20.3
Total	123	100

Source: Field Survey, 2012

3.3 Identified Effects of SSM Activities on the Environment

When respondents were asked to indicate the kind of environmental effects their mining activities had on the environment, a little over half (51.02%) of them indicated that their activity resulted in the degradation of the vegetation cover and the land in the area. Such degradation if not well resolved may have serious consequences on the future use of the land especial for agricultural purposes and for the purpose of infrastructural development since a natural disasters such as earth quake can collapse any infrastructure built on such lands. Also the destruction of the vegetation cover in these areas will contribute to the already increasing global warming and its associated effects. Water pollution was also found to be a major effect of SSM on the environment. About 29% of the respondents identified water pollution as a major effects of their activity on the environment. This is mainly the result of the use of such chemicals as mercury in the purification process. The residual from this process is usually washed down into nearby water bodies and this ends up in the pollution of this water bodies.

This tends to pose serious health risk for people living around the catchment area of the water body. This also tends to have effects on people who consume vegetables or food crops for which such polluted water was used in its production. It tends to also increase the cost of treating such water for consumption. All of these results in the further marginalization of people living in the district. This is because their access to land for agricultural purposes as well as good drinking water reduces. This will go further to increase the already deplorable

situations of indigenes who are not engaged in SSM. More so, about 20.4% representing 20 respondents who stated that their activities adversely affected the environment identified air pollution, noise pollution and the destruction of habitat as the main effects of their activities on the environment. All these have serious implications on the health of people living in and around the area for the SSM activities and can also result in the destruction of the eco-system. Air pollution for example, can result in respiratory diseases such as TB and Lung cancer.

Table 3: Identified effects of SSM activities on the environment

Response	Frequency	Percentage
Degradation of Land and Vegetation	50	51.02
Water Pollution	28	28.57
Air Pollution	11	11.22
Noise Pollution	6	6.12
Destruction of Habitat	3	3.06

Source: Field Survey, 2012

Notwithstanding the fact that most people are aware of the destruction of the environment by small scale gold mining activities, the majority (78.9%) of the respondents(as indicated in Table 4) are not doing anything to reduce or curtail the environmental effects. This may be as result of the fact that they lack the necessary support and technical know-how to reduce the negative effect of their activities on the environment. Hilson (2001) for example noted that, efforts by the government to help in the reduction chemical emissions failed because of non-subsidization of the equipment used for that purposed. This means, small scale miners can do very little to eliminate or reduce the effect of their activities on the environment despite the fact that, they know their activities adversely affect the environment.

Table 4: Attempts to reduce adverse environmental effects of mining

Responses	Frequency	Percentage
Yes	26	21.1
No	97	78.9
Total	123	100

Source: Field Survey, 2012

3.4 Mining and Health

Mining involves the use of various chemicals which have serious health implications on the miners who use it for their day to day activities. Pollutants such as dust and the like have resulted in more harm being caused than doing good. Table 5 shows the various diseases the respondents have been suffering. Most (49.6%) of the respondents interviewed suffered from respiratory diseases, followed by skin related diseases. This result is consistent with the Ghana health service report on **t**uberculosis (TB). The number of TB cases recorded at Takwa-Nsuaem municipality in 2011 was as high as 187. A similar result was also obtained by Yeboah (2008) for Obuasi. Yeboah (2008) also identified respiratory tract infections, malaria and skin diseases as main effects of mining activities on the health status of people. Although it is difficult say with confidence that mining activities are responsible for such diseases, one can easily attribute respiratory tract diseases to mining activities since respondents identified air and water pollution as a major effect of their activity on the environment and this can actually cause some this diseases stated above and as indicated by Yeboah (2008)

Table 5: Mining Related Diseases

Responses	Frequency	Percentage
Respiratory diseases	61	49.6
Malaria	29	23.6
Skin diseases	30	24.4
Diarrhoea	1	0.8
Injury	2	1.6
Total	123	100

Source: Field Survey, 2012

When the respondents were asked whether the diseases they have been experiencing are linked with their involvement in the mining operations, 52.8 percent of respondents responded in the affirmative. On the other hand, 47.2 percent did not link the diseases they have been suffering from to their involvement in the mining operations as indicated in Table 6. This clearly supports the exposition provided by Labonne & Gilman (1999) on the linkage between mining activities and diseases associated with it.

Table 6: Linkage of diseases to mining activities

Responses	Frequency	Percentage
Yes	65	52.8
No	58	47.2
Total	123	100

Source: Field Survey, 2012

Being aware of the cause of something is the first solution to a problem. Table 7 reveals the measures undertaken by the respondents to reduce the effect of mining on their health. Most importantly, they have adapted to the drinking of wholesome water such as treated sachet water of which 78 percent of respondents are involved in. Again, since mining operations entailed the release of tons of dust which come with toxic chemicals into the atmosphere, 17.1 percent of the respondents put on respiratory mask as a way of reducing the effect of mining on their health. This clearly shows that miners are doing very little to reduce the effect of mining activities on their respiratory system. This is because small scale miners mainly suffer from respiratory tract disease and only 17% of the respondents are taken steps to address this problem.

Table 7: Measures taken to reduce the effect of mining on health

Responses	Frequency	Percentage
Putting on respiratory mask	21	17.1
Boil drinking water	3	2.4
Drink different source of water	96	78
Others	3	2.4
Total	123	100

Source: Field Survey, 2012

As indicated in Table 8 most (69.1%) of the accidents associated with small scale mining operations largely due to landslides. This has been the case as most of them use crude technology in digging the ore from the earth with little or no safety measures being taken. This situation usually emanate from the fact that most of the small scale miners do not have the resources and appropriate technology to prevent some of these accidents. This was indicated by Aryee *et al.* (2003).

Table 8: Accidents associated with mining operations

Responses	Frequency	Percentage
Falling of rocks	21	17.1
Landslides	85	69.1
Collapse of working face	9	7.3
In rush of water into the mine	8	6.5
Total	123	100

Source: Field Survey, 2012

The majority (87.8%) of the respondents were aware of the dangerous nature of the mining operations to their life whiles 12.2 percent of them are not aware. Notwithstanding their awareness people are still into the small scale mining. This has been the situation, because of the non- existence of other alternative livelihoods for them to engage in. This means most of small scale miners go into mining as result of poverty. The result is consistent with the arguments put forward by Labonne & Gilman (1990).

Table 9: Awareness that mining is dangerous to life

Responses	Frequency	Percentage
Aware	108	87.8
Not Aware	15	12.2
Total	123	100

Source: Field Survey, 2012

4.0 Conclusions

Poverty and unemployment are the major push factors for people to engage small scale mining. Small scale mining is mainly done by migrants rather than indigenes of the communities. Small scale mining actually results in environmental degradation and little effort is made to reduce environmental pollution. Finally, small scale mining activities adversely affect the health of people involved.

It is recommended that steps be taken to educate small scale gold miners on the need to reclaim the land after their operations. SSM should also adopt modern and efficient mining techniques that will help protect both the environment and their health.

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