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Surface Mining and Community Development In The Tano-Suraw Forest Reserve In The SefwiWiawso District: Ghana.

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ABSTRACT

The study investigatedthe environmental challenges posed by surface mining, its effects on the livelihoods of vulnerable groups andthe contributions of surface mining to community based development in Paboase and Akoti communities.
Simple random and purposive sampling techniques were employed to reach 255 respondents. Primary data were obtained using structured interviews, questionnaire, focus group discussion and observation guide. The data were analyzed and presented using frequency tables and cross tabulation on descriptive perspective.Surface mining has resulted in loose ridges of mine waste on large expanse of vegetated land. Opened mine waste dumped and the movement of heavy duty trucks produced enormous dust settling on the vegetation; limiting respiration and photosynthesis. Pollutants, though within permissible levels,endanger the biotic component of the ecosystem.Majority of the community members are farmers. Surface mining on their farms and the high technology employed in the miningnarrows their livelihood strategies. Indigenes have very limited skills to explore alternative livelihood sources. The communities have not experienced significant development in the lives of the people because the mining industry is well structured that very little economic relation exist between the mining company and the local economy.

Introduction

There are increasing number of multinational corporations in the gold mining industry in Ghana. According to ISSER (2004), the mining sector in Ghana has contributed 56% of the total Foreign Direct Investment (FDI) in 2003 for mine expansion, rehabilitation, new exploration and mine development. The flow of FDI into the mining sector raises questions as to whether it is to the benefit of the foreign investors or the host country especially the communities in which they operate. These doubts are because of the associated disruption of the local environment, social and cultural structures of the communities and the vegetation cover where mining is done.

The Tano-Suraw Forest Reserve has been a source of livelihood for the people of the Akoti and Paboase communities who live within and very close to the reserve respectively. There seemed to be great competition to access and use of natural resources between the Chirano Gold Mine Limited's (CGML), the government of Ghana and the local peasant farmers.

The pristine forest which has been a dependable source of livelihood for the vulnerable groups and the communities at large is now strictly monitored by the Chirano Gold Mine Limited. Thus, the disadvantaged and the vulnerable groups in the rural communities bear the full brunt of the mining operations.

It, therefore, appears that the environmental cost imposed by surface mining far outweighs what it takes to enhance ecological succession. Despite the fact that surface mining is very lucrative and serves as a source of livelihood to many families, it is unbearable and unsustainable especially when appropriate methods are used to quantify its contribution to environmental sustainability. The intensity of this unfortunate situation seems to advance adversely as one moves from Paboase to Akoti communities towards the forest reserve where surface mining has resulted in the displacement of families, loss of arable lands, dissolution of cultural practices and total detachment of humans from the environment (a situation that gingers massive destruction of the environment for personal gains (Chiras, 2001)). Surface mining activities has resulted in large deposits of mining waste on the top soil in the Chirano Gold Mine Limited mining zone. These large deposits gradually contaminate the top soil, polluting and destroying micro-organisms which form the basis of the ecosystems.

It, therefore, becomes unclear as to how surface mining methods would be adopted on this life-sustaining part of the soil with the hope of bringing about economic growth and development since the interaction between the biotic and the abiotic components of the environment is severely disrupted.

Though bad farming practices within the reserve have resulted in some level of environmental degradation, the effects of surface mining on the environment is far beyond the ability of the peasant farmer to make it productive again. The

environmental media: air, water, land and the general atmospheric setting are destabilized during and after surface mining activities.

There are doubts if the environmental, social and cultural disruptions could be mitigated by revenue from the mining industry. These socio-economic and environmental worries, fears and threats to the communities in and around the mining zone of the Chirano Gold Mine Limited and the nation at large stimulated the interest for this study.

The Gold Extraction Process

Relevant literature on the significance of natural resource management and extraction focused on the interplay between the living and non-living components of the environment. An environment becomes degraded if it loses its capacity to perform the primary functions of providing food, shelter and raw materials for domestic and industrial purposes (Dregne, 1983; Tolba, 1986). In a typically degraded environment, the air and water bodies are polluted, soils lose their fertility and are eroded, vegetation diminishes, reproduction of biomass is lowered and diversity of the ecosystem is reduced (UNDP, 1977 in Nsiah-Gyabaah, 1994). Environmental degradation could principally be caused by either natural factors or human activities. Elements such as drought, bush fires (caused by lightning), and floods are active natural ingredients to environmental degradation. On the other hand, human's desire to survive, may at times contribute significantly to environmental degradation.Surface mining is one such human activity that contributes to natural environment degradation and biodiversity loss. Surface mining usually takes place just beneath the earth surface. It involves the identification of rocks with the relevant minerals. Since it does not involve underground works, large areas of top soil are stripped to expose the gold-bearing rocks. This may require use of earth moving machines in the case of large-scale surface mining or manual force in the case of small scale surface mining.

In large-scale surface mining, heavy equipment such as jumper drill, jackhammer and solo are used to make holes on the face of the rocks in which explosives for blasting are inserted. It isan advantage to create enough space for the blasting to allow sufficient fragmentation of the rock into workable sizes. This initiates the blasting process. Jaimin and Holmber (1994) describe blasting as the loosening of the existing rock structure to enhance easy and efficient loading and hauling. It is a very dangerous stage in mining. The process involves rapid splitting of rocks and the release of particulate matter. In an uncontrollable manner, these contribute to ecological instability. Propelling rocks, which are very close to the earth surface, could be very fatal. The dusts released are agents of diseases related to respiratory tract infection. Plants have their share of dust blocking the stomata (the medium of gaseous exchange), leading to inadequate supply of carbon dioxide and oxygen gases, which are very active ingredients for photosynthesis and respiration respectively.

Holmberg (1984) warns that blasting requires specialized expertise due to the use of explosives. During blasting, adequate studies must be conducted to know the type of rocks available and the type of explosives suitable for the process of fragmentation. These precautions are necessary because blasting is commonly accompanied by throwing of rock particles apart, excessive noise and vibration of the ground. In addition, warning signals must be provided to alert miners and passers-by. All loose rock parts on the surface are scaled down to avoid rock-falls which can be very fatal.

In the event of improper blasting, the process can result in ground motions of sufficient intensity that can damage structures within and outside the mining premises. Jaimin and Holmber (1994), therefore, advise that mine blastmen should adhere to a comprehensive blasting regulation developed by the United State of America (USA) Office of Surface Mining, Reclamation and Enforcement (OSMER), which is purposely designed to control the ground vibration with regard to acceleration, velocity and displacement.After successful blasting exercise, excavators, wagon and dump trucks are used in loading and hauling disintegrated gold-bearing rocks to the dump site for further processing.

The fragmented gold-bearing rocks are subjected to drastic milling process to obtain a powdered form of the ore. The commonly used chemicals in gold extraction are mercury and cyanide. Mercury is a very useful reagent to gold extraction because it easily forms alloys with other metals. Thus, mercury easily combines with the gold in the ore to form the amalgam. The gold and mercury are finally separated based on the differences in their boiling points. When subjected to intense heat, mercury with a lower boiling point of 357 degree Celsius vapourises leaving the gold behind (Ayensu, 1997).

In the use of cyanide for gold extraction, a process known as MacArthur-Forest process is employed. In this process, gold-bearing ore is ground up extremely finely and then treated with a very dilute solution of sodium cyanide or calcium cyanide with water and oxygen present. The ore and the reagent are thoroughly mixed to allow adequate interaction between the gold and cyanide. Gold can thus be extracted from the resulting product. Miners maximize profit by engaging more than one gold extraction processes such as the use of mercury followed by the MacArthur-Forest process (Jones, 1970).

Environmental Effects of Surface Mining

According to Chiras (2001), minerals are part of a production– consumption system that involves exploration, mining, processing, transportation, and enduse. Many of these activities can cause some level of environmental damage. Gold extraction processes involve use of chemicals to convert the ore into an extractable form. When the mineral is obtained, all efforts are focused on the mineral; nothing else comes close. The result is the cumulative effect of the used chemicals on the land. Among other commonly used chemicals in the extraction of gold is mercury. Gavin

(2001) notes that mercury amalgamation technique is relied upon heavily as it is a cheap, dependable, portable operation for concentrating and extracting gold from low grade ore. However, such chemical in large quantities could be lethal to the biotic component of the ecosystem. This totally disorientates the stable interplay among the biotic and abiotic components of the ecosystem from which life orientates.

Ghanaian government, with the knowledge of the deadly nature of mercury on the biotic component of the ecosystem, introduced the mercury retorts. This recycles used mercury but the process was too expensive to stand the test of time. The reclamation fund introduced by the Mineral Commission also did not survive. The introduction of paltry tax forms and the mining reforms in the country have been an inducing incentive that keeps the industry flourishing (Agbesinyale, 2003).

Despite the measures taken by Ghanaian government to stimulate and sustain effective and environmentally friendly mining practices, there are still waste management problems facing mining communities. Indiscriminate deposits of mine waste on pristine land as well as the clearing of large expanse of forest, and digging of trenches ignite erosion which is an inducing agent to land degradation. This possibly might have stimulated Stocks' (1977) assertion that God has always cursed the land in which resources lie. Iddirisu and Tsikata (1998) indicate that it is common for prospective gold mining sites to be stripped bare of the vegetation and where deep underground mining has occurred that pits are left uncovered and abandoned. Surface mining leaves the most productive part of the soil unsuitable for agricultural purposes and other non-mining industries get seriously paralyzed.

The fine particulate matter released from the mining sites often destroys the vegetation and creates desolate, barren landscape. The pollutants equally damage sensitive cell membranes, disrupting plant metabolism, growth and development. Laing (1994) indicates that all dust, whether toxic or not, present a serious nuisance for nearby communities and has damaging effects on vegetation, by blocking plant pores and reducing light penetration and photosynthesis. Mining related air pollutants include: sulphur dioxide, arsenic oxide, nitrogen oxide and particulate (dust and smoke) (Laing, 1994). The UNEP indicates that mineral extraction and processing are responsible for about 10% of Ghana's industrial pollution (ODA, 1992). The forest, which serves as a block to wind, maintains local rainfall and humidity level and a habitat for varied species is gradually cleared as a result of massive exploitation of the gold within the region of interest.

It therefore suggests that gold mining leads to deprivation of agricultural lands, disease and social instability. Mining everywhere is, therefore, seen as a "dirty industry" because of the biospheric pollution through discharge of toxic waste substances and also degradation of land resources through its extractive process (Ripley and Crowder, 1996).

Acquah (1992) asserts that until the 1980s, about 90 per cent of mineral

extraction in Ghana, particularly gold mining was undertaken deep underground with the remaining 10 per cent operating surface open cast mining. This, to a very large extent, allowed for the co-existence of mining and non-mining industries which contributed significantly to the national economy. Unfortunately, the story has reversed since mid 1980s and it is anticipated that in less than 10 years, all mining activities in Ghana will be surface open-cast with cyanide heap leaching method dominating. It is clear that surface mining poses more environmental challenges than the underground mining because its operation is on the surface of the earth. Surface mining leads to more pollution of water, land and air than underground mining. Surface mining produces about eight times more waste per ton of ore than underground mining (UNEP, 1993:299; Ripley and Crowder, 1996). This has been given a credential accent by Chiras (2001) who indicates that rock waste from surface mining is typically deposited on the land near the mine – burying vegetated areas. Mine waste (tailings), may gradually leak into nearby lakes and streams. This can retard the free flow of water and, therefore, causing flooding; toxic wastes also contaminate water bodies and very lethal to aquatic life. This results in the reduction of the quality of water which otherwise could be potable to the living component in the ecosystem.

According to Chiras (2001), water pollution is any physical or chemical change in water that adversely affects organism. Water pollution comes from numerous sources both natural and anthropogenic. Anthropogenic sources are the most important because they tend to be localized and thus contribute significantly to the deterioration of local water ways or ground water. For example, sulfur present in tailings may combine with water to form sulfuric acid, creating acid mine drainage, which is lethal to fish and numerous aquatic organisms. However, pollutants may also arrive from air and the surrounding land. This is referred to as cross-media contamination, specifically the movement of pollutants from one medium (such as air) to another (such as water).

It is unfortunate to note that the compensation paid to the host communities of these hideous mining activities is always highly inadequate since it is based on the traditional count of destroyed plants within the concession. It does not adequately cater for the resettlement and creation of new farmlands of the displaced communities. Chiras (2001) further asserts that minerals exploitation creates environmental damage on a scale matched by only a few other human activities. It is responsible for deforestation, soil erosion, water and air pollution. The environmental impacts are particularly severe in less developed countries which produce a large portion of the world's minerals.

Study Area and Research Methods

The Tano-Suraw Forest Reserve transcends the SefwiWiawso District. Akoti and Paboase communities of the SefwiWiawso District are located within the reserves and very close to the reserve respectively. The communities and the

reserve are situated about 100 km southwest of Kumasi and about 37 km from Bibiani. The area is within the rain-forest zone in Ghana. Palm trees, cassava and cocoa trees are commonly cultivated crops within and close to the reserve.

Gold exploration within the reserve revealed a gold mill capacity of about 2.6 Mt. The mill has been operating at that level since December, 2005 (htt://www.redbackmining.com/s/chirano) Gold extraction by the Chirano Gold Mines Ltd is estimated at 123,000 ounces of gold per annum over a period of 8.5 years mines life. Gold deposits have been found along the following areas: Akwaaba, Suraw, Akoti South, Akoti North, Akoti Extended, Paboase, Tano, Obra South, Obra, Sariehu and Mamnao. Since September, 2005, gold extraction has been on the high side (Daily Graphic, 7th Dec., 2005). Personal observation (2008) at the site has revealed that active surface mining is ongoing at Akoti South, Akoti North, Akoti extended and Paboase. However, adequate preparation has been made to start underground mining at Akwaaba.

The target population included some senior staff of the Chirano Gold Mines Limited, the Traditional Authorities (chiefs, elders and women leaders), nurses at Paboase clinic and local community members who resided in either Paboase or Akoti communities as at March 2008. Relevant government officials such as District Director of the Environmental Protection Agency (Tarkwa), District Director of Environmental Health, District Manager of Forestry and Wildlife and the District Economic Planning Officer all at SefwiWiawso, the district capital.

The population of Paboase and Akoti communities was 2797 (SefwiWiawso EHD, 2008); adequately represented by a sample size of 182 (Fisher, et al., 1998). The 182 respondents were randomly sampled and interviewed. Also, 63 of the 72 senior staff of the CGML were randomly sampled and interviewed on methods of gold extraction and mine waste disposal. Key informants included the four relevant government officials. They were given questionnaires to respond to issues of gold mining in the TanoSuraw Forest Reserve. The researcher also used an observation guide to record any physical challenges posed by the mining activities. Twelve focus group discussion sessions were conducted to seek the collective views of members of the two communities. Secondary data were obtained from the Human Resource Division CGML, (2008), Department of District Environmental Health, minutes of the Community Consultative Committee meetings and reports by the Parliamentary Select Committee on the Environment and Science as well as any material that deals in parts or aspects of the topic concerned.

Results and Discussions

Activities and processes involved in surface mining

The majority (68%) of the workers of the CGML did agree that the blasting process is accompanied by enormous release of dust into the environment near and far (Table 1). This confirms the assertion by members of the communities (79%) that they have experienced intense particulate

matter in the air with the upsurge of surface mining in the communities. However, according to the EPA (2009), the monthly mineral commission/mines department returns for December, 2008 was not available to indicate the values of the dust produced during the period. The company's representatives assured the researcher of adequate precautions to reduce the effects of dust in the communities and the workers around the blasting sites.

It was observed that workers had mask on to filter the air that they breathe in. Also the feeder roads were periodically watered to reduce the intensity of dust produced by the moving vehicles. Traditional authorities also confirmed the prior warning signals issued before any blasting session. This is in line with Jaimin and Holmber (1994) assertion that mine blast men should adhere to comprehensive blasting regulations developed by the United State of America Office of Surface Mining Reclamation and Enforcement. The high sense of precaution in the mining process was confirmed by the medical personnel at the CGML clinic; that only a few accident cases are reported because of the high level of safety standards. This is also in consonance with the fact that respiratory track related diseases (e.g. Tuberculosis) accounted for 4% of the common diseases in the study area. However, the longterm effect may be borne on children who are the future leaders.

Table 1: Perceived sources of pollutants in mining

Sources	MC		CGML		DA	
	Yes	No	Yes	No	Yes	No
Blasting process	148(79)	39(21)	43(68)	20(32)	3(60)	2(40)
Heap leaching	71(38)	116(62)	38(60)	25(40)	5(100)	0(00)
Ore roasting	88(47)	99(53)	55(87)	08(13)	4(80)	1(20)
Waste dump	170(91)	17(09)	50(80)	13(20)	4(80)	1(20)

Note: Percentages are in parenthesis
Source: Field Survey, 2008.

As indicated in Table 1, 60 percent of the workers of the CGML acknowledged the use of mercury and cyanide (heap leaching) in the extraction process. The use of these chemicals is very cheap but could be very harmful to the ecological make up in the mining area. As indicated in Table 1, selected workers from the district assembly unanimously (100%) agreed that heap leaching is a very crucial source of pollutants. However, no pollution from heap leaching has been reported since the commencement of commercial surface mining in the communities. This was confirmed by EPA (2009) that cyanide as a toxic water pollutant within the up and down streams of the Suraw and Paboase rivers is less than 0.01mg/l which is far below the maximum permissible level of 1.0mg/l.

Another distasteful aspect of gold mining is the management of mine waste. As

indicated in Table 1, about 80% of selected senior staff of the CGML and 91% of the members of the communities agreed that the mining waste generated by Chirano Gold Mines Ltd is disposed of by dumping on the open fields (Plate 1). Chiras (2001) reports that most often rock waste from surface mining are typically deposited on the land near the mine – burying vegetated areas. As a result, the majority (56.8%) of the community members who are farmers have their livelihoods assets threatened. Also, the limited skills as indicated in the level of education attained by the community members depict the narrow scope for individuals to explore alternative livelihood sources.

Plate 1: Open field waste dump by the CGML at Akoti
Source: Field Survey 2008.

Land Degradation and Bio-Diversity Loss

According to Dzigbodi-Adjmah (1996), in all mining areas, large portion of pristine lands are occupied by mine dumps consisting of slime or crushed rocks that are a legacy to many years of mining. This is very real in Paboase and Akoti communities (Plate 2). About 56.8% of the respondents who are engaged in subsistence farming as their livelihood expressed with intense feeling the massive land degradation they have experienced with the onset of surface mining in their communities. Mine wastes have been deposited within the Akoti community. It is, therefore, a source of great worry to the community members. Not only will these wastes be a legacy in years to come, they are presently posing serious challenges to their water sources, land and the air. This reiterates Chiras' (2001) observation that mineral exploitation creates environmental damage on a scale matched by only a few other human activities. It is responsible for

deforestation, soil erosion, water pollution, and air pollution. The environmental impacts are particularly severe in less developed countries which produce a large portion of the world's minerals.

Plate 2: A wide field of waste dump
Source: Field Survey, 2008.

Observation, by the researcher, in and around Paboase and Akoti communities indicated that the vegetation and biodiversity loss is fast spreading (Plate 2). The manager of the Forestry and Wildlife Division indicated that before mining the forest was partly destroyed by cocoa farmers. The manager confirmed that the vegetation cover is fast lost with the upsurge of surface mining by the CGML. Surface mining activities has diminished the natural habitat of living organisms ranging from insects and micro plant species to mammals and higher plant species. It is however difficult to predict how fast the vegetation is being cleared since it is partly determined by the producer price index of gold in the international market. Agbesinyale (2003) observed that records from the Minerals Commission as far back as 1991 showed that about 11.4 million hectares of open forest lands have been leased to mining companies for prospecting and the extraction of precious metal. This land area is most likely to have tripled today since many mining companies are now into surface mining which is cheap and engulfs wide area of land.

Field data (Table 2) indicated that 71.1% of the respondents strongly agreed that surface mining has resulted in land degradation in Paboase and Akoti. The respondents attributed the wide spread of

the land degradation to the heavy earth moving equipment used by miners to clear the life sustaining top soil of the ecosystem. This raids the soil of valuable life sustaining nutrients. It further results in the unprecedented loss of the living components, especially the decomposers which constitute the basis to coordinating life at that part of the earth. This therefore ignites erosion, a strong inducing agent to wide spread land degradation and disruptions of the ecosystem in general.

The deplorable situation of the forest land in Paboase and Akoti communities is further compounded by the use of cyanide heap leach methods in the gold extraction process. This method has adverse effects on humans and the surroundings on which they depend.

Table 2: Effects of surface mining on the quality of land, water and air

Effects of surface mining	Disagree (%)	Not sure (%)	Agree (%)	Strongly agree (%)	Total (%)
Land degradation	0.0	6.0	22.9	71.1	100
Land pollution	1.2	8.3	53.1	37.4	100
Water pollution	0.0	2.3	67.2	30.5	100
Air pollution	1.4	9.2	43.4	46.0	100
Noise pollution	9.3	31.3	39.0	20.4	100

Source: Field Survey, 2008.

About 37.4% of the respondents strongly agreed that surface mining has contributed significantly to land pollution in the communities (Table 2). The focus group discussion asserted that mining wastes are dumped right in the communities. Respondents frequently point to the loose hills and long ridges made of earth and rock waste dumped in the communities (Plate 2). EPA (2009) confirmed that about 3.5 tons of the total waste generated in the operation is left in the land fill.

Members of the focus group discussion complained that the situation becomes worse in the dry season when the few trees cannot withstand the effects of the wind on the loose soil. Some women indicated that even water drawn from the boreholes is contaminated as they carry it home. Nearly 53.1% (Table 2) of the respondents did agree that surface mining really contributed significantly to land pollution. A cross check at the Department of Environmental Management in the mining company revealed that adequate measures are taken to reduce the effects of surface mining on the land and its living components.

Respondents, who became happy when the news of exploration and extraction was broken about six years ago, now deeply regretted that the gold on which they sat on for years has become a serious threat to their main source of livelihood - subsistence farming. Farmers have lost their farms which are within the concession of the company. Moreover, the degradation caused by the company did not regard the boundaries of the company's concession.

Respondents, however, appreciated the construction of feeder roads within and beyond the communities. This gives them easy access to neighbouring communities but they have to cover long distances to their farms since they have no place to farm within the village. This also reflected the easy access by individuals to otherwise closed forest areas. The chiefs and elders of the two communities said farming is no longer attractive because of the effects surface mining has brought onto their farm lands. Residents of Paboase and Akoti are, therefore, compelled to engage in other income-generating ventures which, when critically examined, adds to the burden surface mining has brought onto the communities and the immediate environment.

The alternative sources of livelihood which residents of Paboase and Akotiengaged in are shown in Figure 5.

The analysis of the data indicated that 93 (49.1%) of the respondents are now into commercial fuel wood gathering; 40 (21.2%) of them are now engaged in commercial charcoal burning; 27 (14.6%) of the indigenes are now into logging and 10 (5.1%) palm wine tappers. These livelihood ventures depicted the extent to which the forest is being depleted by the mining company and the indigenes. According to the Ghanaian Chronicle (2007), ample time was allowed for the harvesting of economic trees within the reserve in which license was granted to the company to commence active surface mining. The newspaper further indicated that it would take hundreds of years before the forest reserve could be of brought back into its original state in the face at the expensive damage that had been caused to it.

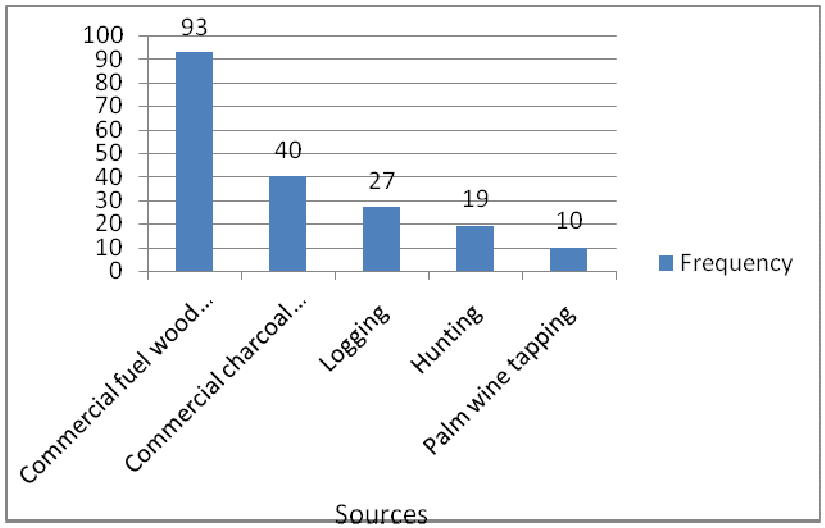

Figure 5: Alternative sources of livelihoods in communities

Source: Field Survey, 2008.

The nights that the researcher spent in these communities gave him a feel of the resource extraction in the communities. The day is crowded with the movement of

the heavy trucks and the chain saw operators and the evening is characterized by explosions at the mining sites. There is the fear that by ten years time the Akoti community will be extinct.

Interaction with some mine workers at Chirano Gold Mines Ltd indicated that the most probable source of land pollution is chemical pollution of soil which could be due to improper discharge or dumping of mining waste on the soil. The workers were quick to add that adequate measures were being taken to curtail the haphazard dumping of mine wastes. Chiefs and opinion leaders also confirmed the caution with which the company operates. Respondents attested to the fact that there has never been any recognizable land pollution but expressed fears for the generationsto come. Women in the FGD expressed their inability to detect the extent of chemical pollution mining was causing since they could not detect that physically and cannot project what happens in the near future. In addition, data from EPA (2009) indicated that other hazardous wastes generated at the mine site are: oil filters (1.43tons), waste oil (7.38tons), empty cyanide boxes (55 boxes) and chemical waste (0.42tons).

Conclusions

It can be concluded that the methods and related activities of mining have both positive and negative relationship with the environment. The positive impact was the opening up of the environment for the indigenes to access alternative sources of livelihoods and the negative impacts were the biodiversity loss and the wide range of pollutants discharged into the environment. Hence with the emphasis on sustainable resource extraction, the benefits of mining could be used to offset the inevitable negative effects associated with the mining process.

The unskilled indigenes, majority being vulnerable groups, have very limited means to identifying or exploring alternatively sustainable livelihoods sources. The vulnerable groups are said to experience very hard times in attempts to make ends meet. The immediate forest is now far from reach because of the high security from the mining company; their lives are hanged on very limited forest produce and very unfavourable local economy. Unfortunately, it emerged that there is a very weak coordination and collaboration between the established institutions and agencies responsible for monitoring the state of the environment in natural resource extraction areas.

There is a very thin link between the formal mining sector and the informal and indigenous activities members of the communities engage in. This has resulted in a very limited capital injection into the local economy. Community base development is paltry.

Recommendations

The Community Consultative Committee (CCC) and the Environmental Protection Agency (EPA) need to ensure that surface mining methods and related activities are constantly matched with bestfit practices, as recommended by the USA Office of Surface Mining Reclamation and Enforcement Agency, to stimulate and sustain environmentally friendly gold extraction.

The Chirano Gold Mines Ltd and SefwiWiawso District ought to consider opening up opportunities for the non-mining industry to diversify the economy of the locality. For instance, chances can be given to the agro-processing sector, intermediate agricultural technology and other mining support services. This will generate employment opportunities to the indigenes who will inject some capital into the local economy.

The SWD agricultural extension officers need to ensure that indigenes of Paboase and Akoti communities adopt improved farming methods and application of appropriate technology to enhance their living standards despite the limited total farm land area.

The EPA needs to constantly ensure that conventional and non-toxic pollutants as well as recognizable toxic materials are adequately detoxified before they are released into the environment.

The Ghana Forestry Commission and the Environmental Management Department of the Chirano Gold Mines Ltd need to recover the vegetation lost within the mining concession to rejuvenate life in the ecosystem.

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