

## ENVIRONMENTAL ISSUES OF ARTISANAL AND SMALL-SCALE MINING IN THE TARKWA MINING AREA OF GHANA

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### ABSTRACT

We made site visits to determine potential environmental issues caused by artisanal and small-scale mining (ASM) in the Tarkwa Mining Area (TMA) of Ghana. Activities of the diggers were observed to degrade vegetation, land and water. Improper handling of mercury was also identified as a major threat to people and ecosystem. Large abandoned pits and trenches posed fall traps to farmers, hunters and wildlife. We argue that lack of adequate monitoring and regulatory enforcement by Ghanaian authorities, together with inappropriate mining processes, probably due to lack of technical expertise are contributing factors to the environmental issues of artisanal and small-scale mining in the TMA.

### INTRODUCTION

Environmental degradation caused by artisanal and small-scale mining (ASM) has been a major concern to many people and governments around the world. ASM is often associated with health, safety and environmental issues in communities where it is practiced (Kitula, 2006; Asiedu, 2013; Sousa *et al.*, 2010). Some of the environmental issues that have been reported include land degradation, mercury contamination, cyanide release, and pollution of rivers/streams. These issues have been attributed to improper mining methods, inefficient technology, lack of technical training and environmental awareness, and lack of regulatory enforcement (Serfor-Armah *et al.*, 2005; Bansah *et al.*, 2016a; Hentschel *et al.*, 2002).

In Ghana, ASM typically occurs in rural communities, providing jobs to many people and contributing towards socioeconomic growth of the country (Banchirigah & Hilson, 2010; Bansah *et al.*, 2016b; Osei-Kojo & Andrews, 2016). As a result of the environmental issues, many people have called on government to develop drastic measures to control ASM operations. It is in this regard that this paper examines potential environmental issues caused by ASM in the Tarkwa Mining Area in Ghana, and suggests mitigation measures to ensure environmental sustainability.

ASM in the area comprises of registered (licensed) and unregistered (unlicensed) operations that adopt surface or underground mining methods to exploit gold-bearing materials. Surface operations typically involve clearing of vegetation, removal of overburden, excavation of mineral deposit, washing/grinding of excavated gravels and processing with mercury. Except grinding, washing and mercury recovery, underground operations are conducted below ground with limited impact on the surface. Alluvial mining is also commonly practiced in streams and along river banks. These activities can have devastating impact on biodiversity of the ecosystem. To achieve the objective for this study, field visits were made to ASM sites to observe operations and interact with diggers. Visits were also made to host communities of ASM and government officials to obtain their perspectives on ASM in relation to environmental impact.

The study area (Tarkwa Mining Area) is located in the Western Region of Ghana (see Figure 1). It is endowed with natural resources such as gold and manganese. Hence, mining is the major economic activity in the area. ASM is widespread, with 15 registered operations and several unregistered mines. The environmental issues observed in the study have been grouped into three main categories: vegetation and land depletion; water quality and pollution issues; and mercury contamination issues.

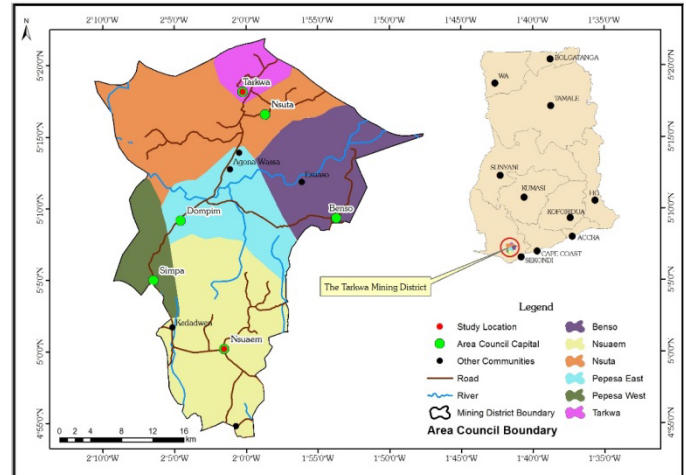


Figure 1. Study Area.

### VEGETATION AND LAND DEPLETION

Degradation of vegetation and land is common in places where ASM occurs. This issue is more critical in areas affected by illegal mining activities. Illegal ASM is nomadic with diggers abandoning excavated sites for new areas in search for gold. As a result, large areas of forest cover get depleted. Large open pits abandoned by diggers also serve as fall traps to farmers, hunters, children and wildlife (see Figure 2). These pits are often filled with water, serving as potential breeding grounds for mosquitos which are a major health (malaria) concern.



Figure 2. Abandoned ASM Pits in the Tarkwa Area.

ASM has the potential to threaten forest resources in the country. For instance, an undisturbed forest zone around the Nsuaem area has been affected significantly by ASM activities. Historical images (Figures 3 and 4) obtained from Google Earth show devastation caused by ASM in the vicinity of Nsuaem between 2003 and 2015. Degradation of forest can lead to displacement of wildlife, habitat loss, and ecological imbalance that affect biodiversity of the ecosystem. Loss of arable lands and deterioration of aesthetic nature of landscape are also typical in ASM affected areas. Studies conducted by other researchers indicated that mining has impacted significantly on vegetation cover in the Tarkwa area (Kumi-Boateng *et al.*, 2011; Kusimi, 2008). These studies, however, did not indicate the type of mining (either large-scale or ASM) that has impacted vegetation in the

area. In many instances, illegal ASM leads degradation of vegetation and land, including protected forest areas.



Figure 3. Undisturbed Forest Area near Nsuaem (2003).



Figure 4. ASM Affected Forest near Nsuaem (2015).

### WATER QUALITY AND POLLUTION ISSUES

ASM depends on large quantities of water for sluicing. Stream/river courses are sometimes diverted into ASM sites, depriving downstream users from their source of water. In some instances, effluents are directly released into the water system without any form of treatment, impacting on aquatic life and endangering the lives of people who depend on the water as their source of drinking water. In other cases, materials are directly washed in the waterbodies. Water quality could be affected by increasing turbidity, suspended solids level and dissolved solids concentration. Heavy metals can also be released into the water through ASM activities. Further, dredging for gold in and around rivers and streams can impact heavily on water quality. Affum *et al.* (2016) collected water samples and river sediments from the Bonsa River located near Tarkwa, and analyzed for heavy metal concentrations. They found high levels of mercury in the river sediments and attributed the situation to ASM activities in the river. Two different streams affected by ASM through effluent discharge and dredging are shown in Figure 5.



Figure 5. Streams Affected by ASM.

### MERCURY CONTAMINATION ISSUES

ASM operators in Ghana generally use mercury for amalgamation. Due to improper handling (Figure 6), mercury losses occur at the ASM sites. In a previous study, Bansah *et al.* (2016a) document some of the ways by which mercury losses can occur in ASM. In this present study, we observed that many diggers are oblivious of the harmful effect of mercury. The few enlightened ones usually ignore precautionary measures when handling mercury. The situation could be attributed to lack of education and technical training. It is important to acknowledge that some licensed ASM operators provide PPE for their workforce. However, many workers avoid using the PPE, stating that using PPE makes them uncomfortable.



Figure 6. Miners Handling Gold Amalgam: On the left, a digger places gold amalgam in a metallic ladle with charcoal fire and fans it by blowing air with the mouth. On the right, a miner places mercury in the bare palm.

Additionally, tailings in ASM are usually piled without any proper storage facilities. The tailings which may contain mercury are washed by rainwater into surrounding soils, vegetation or water systems, and potentially threatening the ecosystem. Soil and water resources can be affected while a significant threat can be posed to people, wildlife and other organisms that depend on such resources.

### WAY FORWARD

Mitigating adverse environmental impact of ASM requires education, technical training of diggers, regulatory enforcement, and policies that involve participation of local communities and diggers in decision making. Lack of education and technical training of the diggers contribute to the environmental issues. This is because, improper mining processes are typically adopted without much regard for environmental preservation. It is important for authorities responsible for ASM in the country to organize educational and training programs for licensed operators to improve their mining methods and ensure environmental protection.

For illegal mining, efforts by government, including military intervention have failed to control the operations. Hence, new strategies could be developed to curtail illegal mining. Such strategies could involve dealing with bureaucratic and cumbersome licensing processes, and recognizing illegal miners and involving them in decision making. A majority of illegal miners feel that the procedure for ASM license acquisition is expensive, bureaucratic and cumbersome, deterring them from seeking license. Many illegal miners are unable to raise the funds required for ASM license. Also, the miners feel that they are unrecognized and marginalized by government institutions, even though the lands they operate on belongs to their families. Usually, these lands are leased to large-scale mining companies without active participation of landowners. This might be due to provisions under Ghanaian laws, that, mineral resources are vested in the government. Thus, crucial consideration of existing regulations and policies is important to mitigate illegal ASM. Efforts could involve allocation of parcels of land to landowners to conduct ASM.

Lack of effective monitoring and regulatory enforcement could be attributed to lack of resources as observed by Bansah *et al.* (2016a). Thus, government should ensure provision of adequate trained personnel, capital and facilities for effective monitoring and regulatory compliance. Further, it is important to encourage active participation of ASM host communities in environmental impact discourse. This can help in policing ASM activities to complement efforts by authorities.

## CONCLUSION

Artisanal and small-scale mining (ASM) is a major threat to sustainability of the environment in the Tarkwa Mining Area. Environmental issues of ASM in the area have been classified into three main issues: vegetation and land depletion; water quality and pollution issues; and mercury contamination issues. ASM is observed to cause degradation of forest resources, land, water, and affecting biodiversity. Many of the devastations are caused by illegal ASM activities. The issues identified in this paper could be attributed to lack of technical expertise by miners, ineffective monitoring by authorities and lack of regulatory enforcement.

Impact of Reprocessing Mercury-Contaminated Tailings in the Artisanal and Small-Scale Gold Mining Sector: Insights from Tapajos River Basin, Brazil", *Journal of Cleaner Production*, 18(16), 1757-1766.

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