

Effects of Loss of Agricultural Land Due to Large-Scale Gold Mining on Agriculture in Ghana: The Case of the Western Region

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ABSTRACT

Objective: This study investigates and describes the effects of loss of agricultural land due to large-scale gold mining on agriculture in Ghana.

Method: The study was a desk review of secondary data including peer-reviewed journals, e-books, conference proceedings, multinational company reports, and ministry and NGO reports. The data was analysed using qualitative content analysis.

Results: Analysis of the agro-based alternative livelihood programmes (ALPs) provided by large-scale gold mining companies to their stakeholder communities showed high start-up cost, insufficient earnings and lack of proper consultation hindered their success. The agro-based ALPs were also found to be focused on cash crop development to the neglect of traditional food crops. A case study of the Tarkwa Nsuaem Municipality of the Western Region revealed a trend of decreasing agricultural land on mining companies' concessions as mining related activities increased. This contributed to joblessness and the loss of labour from agriculture to other livelihoods in the mining communities.

Conclusion: The study concludes that the effects of loss of agricultural land due to large-scale gold mining on food crop production in the mining communities can be substantial. This can affect food crop production in Ghana in the longer term, as the mining communities are also important food production centres.

Keywords: Agriculture, Productivity, Gold mining, Corporate social responsibility, Livelihoods.

INTRODUCTION

In mineral-rich countries, particularly developing countries, the mineral sector plays an important role¹. In Ghana, mining contributes about 41% of the total export earnings and 12% of government revenue². However, large-scale mining can negatively impact on other sectors such as agriculture³⁻⁶. Mining in Ghana usually takes place in rural communities where the people are poor and depend on the utilisation of natural resources and subsistence farming⁷. These areas are also important agricultural production centres for the country. For example, in the Tarkwa Nsuaem Municipality (formerly Wassa West District), where agriculture is the main economic activity, engaging some 40% of the population⁸, about 70% of the total land area has been leased as concessions to mining companies⁹.

Smallholder farming is the main form of agriculture in Ghana, with 90% of the farms being less than two hectares in size¹⁰. Agriculture is very important to the economy of Ghana and rural livelihoods. The agricultural sector accounted for 35% of Ghana's Gross Domestic Product (GDP) in 2009¹¹ and employs about 60% of the country's labour force (12).

Few studies have considered the effects of leasing such large amounts of land in a major agricultural production area. Studies on the effects of mining in Ghana have focused on small-scale mining and on the environment^{2,13-15}. The few studies on the effects of large-scale mining on agriculture have centred on pollution¹⁶, loss of agricultural land¹⁷⁻¹⁸ and labour migration from agriculture to mining companies¹⁹⁻²⁰. Studies focusing extensively on the combination of these factors (i.e. loss of agricultural land due to large-scale mining and labour migration to mining companies) on agricultural production in Ghana are lacking.

This study reviews and compiles data on the effects of loss of agricultural land due to large-scale gold mining on agriculture in Ghana through the following objectives:

1. Identify and explore the approaches and challenges of agro-based alternative livelihood programmes provided by mining companies to affected communities in the Western Region of Ghana.
2. Determine the proportion of agricultural land lost due to large-scale gold mining in the Tarkwa Nsuaem Municipality of the Western Region and the impacts on agriculture.
3. Determine the effects of loss of agricultural land due to large-scale gold mining on farmers' livelihoods in the Western Region.

The study focuses on the large-scale gold mining sector because of the importance of gold to the economy and the contribution of the gold mining multinationals to Ghana's mineral output. Details of this can be found in the next section. The Western Region presents the ideal case for the study as it has the highest concentration of large-scale gold mines in Ghana²¹ and also makes significant contributions to agriculture in the country. The focus is on a case study in the Tarkwa Nsuaem Municipality of the Western Region, but looks at the broader effects of mining on agriculture in the whole region.

SPECIFIC ISSUES ON AGRICULTURE AND MINING IN GHANA

Overview of agriculture in Ghana

Agriculture in Ghana is mainly rain-fed and on a smallholder basis, with about 90% of farms less than two hectares in size; large plantations are mainly for the cultivation of rubber, oil palm and coconut.

Traditional cultivation methods involving hoe and cutlass are commonly used²². Ghana produces about 51% of its cereal needs, 60% of fish requirements, 50% of meat and less than 30% of the raw materials needed for agro-based industries²³. Table 1 shows the food balance sheet of Ghana for 2010/2011, highlighting the gross biological production, total imports and exports, total supply, estimated net consumption and deficits/surpluses of food commodities²². It shows how Ghana is a net producer of all crops except rice and wheat.

Agriculture is the highest contributor to GDP in Ghana, even though the share of the sector in national output declined from 44% in 1990 to 37% in 2005. The contribution of the sector to Ghana's GDP has varied between 35.8% and 37% since 2000¹¹. The current Food and Agriculture Sector Development Policy (FASDEP) aims to promote the sustainable utilisation of agricultural resources and commercialise activities in the sector to ensure market driven growth. It targets selected food commodities to ensure food security and income diversification, particularly for resource poor farmers. Constraints in the agricultural sector include gender inequality and discrimination against women, access to land and finance, limited public-private sector engagement, and energy availability and costs²³.

FASDEP's strategy for attaining food security focuses on five staple crops (maize, rice, yam, cassava and cowpea). Each district will select two of the crops or livestock annually, based on the district's needs, to be developed. This is expected to be done in partnership with the private sector, Farmers-Based Organisations (FBOs) and NGOs operating in the districts. FASDEP also aims to complement the land policy in supporting land access and security by promoting sustainable land management practices within the agricultural sector²³.

Overview of the gold mining industry in Ghana

Gold is the main mineral commodity in Ghana, contributing over 90% of its total mineral exports²⁴. Two types of gold mines can be found in Ghana: small-scale and large-scale. The small-scale mines are usually operated by self-employed indigenous young men, with little financial support and limited mining expertise. The large-scale gold mines are generally operated by MNCs with operations that are large in physical size and capacity and utilise heavy equipment and the latest mining technology²⁵. The large-scale gold mining companies produce over 90% of Ghana's gold output²⁶. All the mining companies have surface mining operations²⁷. As at 1998, the number of companies prospecting for gold was 237, with an additional 23 having acquired mining licenses. In 2009, Ghana was the second largest gold producer in Africa, and the ninth in the world²⁸.

Mining companies paid a royalty of 3% of gross sales to the Ghana government until 2009, when it was adjusted to 6%²⁹. Eighty percent of this goes directly to the central government's consolidated fund and 10% to administrative departments related to mining oversight. The remaining 10% is distributed to local communities through the Office of the Administration of Stool Lands, which shares the rest among the district administration (5.5%), traditional councils (2%), and local chiefs (2.5%)³⁰. The amount that eventually gets to the local communities which host the mining companies is thought to be insignificant in terms of providing community development³⁰.

The growth of the mining industry has also brought problems, particularly to the host communities³¹⁻³². The expansion of large-scale mining operations has induced landlessness and the displacement of communities^{2, 33-34}. Table 2 provides data on

people displaced by the operations of two large-scale gold mining companies in Ghana, as reported by various stakeholders. Traditional sectors of the economy of Ghana, mainly agriculture, have also been affected due to the expansion of large-scale gold mining operations.

METHODOLOGY

Description of study area

Ghana is endowed with mineral resources including gold, diamond, bauxite and manganese⁴⁰. Gold in particular, is mainly mined on a large-scale in parts of the Western, Ashanti, Central, Eastern and Brong Ahafo regions of Ghana. These fall within the Rainforest, Semi-deciduous forest and Transitional zones of the country, which are also very important agricultural production areas. The Western Region has the highest concentration of large-scale gold mines in Ghana. Table 3 shows all the large-scale gold mining companies in commercial operation in Ghana, and their concessions and operating regions. About one-third of the region has been leased to mining and mineral exploration companies²¹. It has a total land area of 23,921 km², about 10% of Ghana's total land area⁴¹.

Agriculture is the main form of employment in the Western Region⁴¹; other important sectors include mining. Out of the 13 districts in the region, the Tarkwa Nsuaem Municipality is the most important in terms of mining. Figure 1 shows the location of Tarkwa Nsuaem Municipality in the Western Region. In 2005, the municipality contributed 1,371,679 of the 2,024,766 ounces of gold (about 68%) produced by all the large-scale gold mining companies in Ghana⁴². Despite the significance of mining in the Tarkwa Nsuaem Municipality, subsistence agriculture remains the most important source of employment. About 40% of the population are engaged in agriculture,

including 70% of the female population. The average farm size is 1.5 hectares. The main food crops cultivated include maize, cassava, rice, plantain, cocoyam and yam while the cash crops include oil palm, rubber, citrus and cocoa⁸. These are similar to the main crops cultivated in other districts of the Western Region.

Data collection and analysis

This study was a review based extensively on secondary data including peer-reviewed journals, e-books, conference proceedings, multinational company reports, ministry reports, NGO reports, presentations, dissertations and newspaper accounts. The conventional approach to qualitative content analysis which is used when a study aims at describing a phenomenon was used in analysing data for this study⁴⁴⁻⁴⁵.

The process of analysis was done in three phases: preparation, organisation and reporting phases. The preparation phase involved deciding on the unit of analysis and obtaining a thorough knowledge and understanding of the data. Each article obtained formed the unit of analysis. Each was carefully read to get a thorough understanding of the issues being described. Obtaining a thorough understanding of the issues being described in the articles helps in identifying themes from the data⁴⁶.

The organisation phase involved open coding to identify themes and categories from the data. The coding process involved thoroughly reading each article at least once again and taking summary notes. The summary notes for each article and sections of particular relevance to the study topic in each article were given identities. These were sentences, paragraphs or sections which expressed thoughts, ideas and themes of particular relevance to the objectives of the study. In some cases, a whole article expressed a theme. The

identification was necessary to make verification easier.

The summary notes were read several times and cross-checked with their corresponding articles, particularly the sections noted, to verify if the right meanings and themes have been inferred from the article. In the verification process, new themes that emerged were also noted. The verification process was repeated several times. All the themes that were identified were then categorised. The categorisation involved grouping similar and related themes into sub-categories. This helps in describing the phenomenon represented by the themes⁴⁷. Sub-categories were then grouped into categories related to the objectives of the study. The objectives of the study were frequently read throughout the verification and categorisation processes in order to stay focused on the study topic and not to get distracted by the other issues in the articles.

The reporting phase involved thoroughly describing the process and results of the data analysis. The results have been presented and discussed in the subsequent sections according to the objectives of the study.

ALTERNATIVE LIVELIHOOD PROGRAMMES (ALPS)

As part of the CSR initiatives of large-scale gold mining companies, displaced communities are trained in alternative livelihoods with the aim of reducing economic dependence on the mining companies and for the host communities to be self-sustaining after the mines close⁴⁸. The ALPs are developed and managed by the mining companies, together with some NGOs, notably Opportunities Industrialisation Centre International (OICI)⁴⁹. The emphases of the ALPs have been the promotion of agrarian activities and are targeted at communities affected by the

companies' mining operations⁵⁰. Table 4 shows the ALPs by the large-scale gold mining companies operating in the Western Region of Ghana. The agro-based ALPs as presented by the mining companies and the challenges and other stakeholders views are described below.

Golden Star Oil Palm Plantation (GSOPP) Initiative

GSOPP is a community-based company established as a non-profit subsidiary of GSR in 2006. GSR aims to use the GSOPP initiative to address environmental, food access and community concerns⁵². The objectives of GSOPP are to economically empower stakeholder communities as a contribution from mining, reduce poverty through employment generation and the rehabilitation of land used for mine waste disposal, using oil palm to reclaim the degraded land. GSR also aims to use the GSOPP initiative to reduce ASM by providing alternative livelihoods⁵¹.

Land for the plantation is provided by the traditional authorities of the stakeholder communities. GSR provides the initial funding for GSOPP with a dollar per ounce of gold produced⁵⁷. GSOPP adopts the smallholder concept in which each farmer receives 4 hectares of land to cultivate²⁹. GSOPP provides technical support and loans to the smallholder farmers and purchases the fruits from the farmers. It is expected that the plantations will become self-supporting and the smallholder farmers will pay the start-up loans to GSOPP to allow for further development. Other farmers who own land can join the initiative as out-growers. With the out-grower scheme, GSOPP provides technical support and funding in the form of loans to the out-growers and the fruits are purchased by GSOPP. Efforts are made to employ women on the plantations⁵². An estimated 40% of the beneficiaries are women. Women are

encouraged to intercrop the oil palm seedlings with vegetables and other food crops⁵¹.

GSR partnered with the German Agency for International Cooperation (GTZ) in 2012 to further develop the GSOPP initiative. As part of the partnership, GTZ will train 240 farmers under GSOPP in good agricultural practices and integrated farming systems, and strengthen FBOs. GSR on its part will cultivate an additional 80 hectares of oil palm and develop a 150 hectare cocoa plantation. It is anticipated that through the partnership, GSOPP and GTZ will reach out to 15,000 people, including 240 smallholder farmers, 500 part-time workers, 720 families and about 13,500 members of communities affected by GSRs operations⁵⁸. Table 5 provides some further information on GSOPP.

The development of oil palm plantations on a large-scale may pose threats to subsistence food crop production if it limits land for subsistence farming. Although women are permitted to interplant the young oil palm seedlings with food crops, this may no longer be viable when the oil palm matures and the canopy closes. An independent review of the GSOPP programme in 2007 found it could limit farmers' access to land for food crop farming²⁹.

Sustainable Community Empowerment and Economic Development (SEED) programme

The SEED programme was instituted in 2005 as a community development programme with the primary objective of empowering stakeholder communities⁶⁰. GFGL partners OICI in the development and implementation of the SEED programme⁶¹. The programme is funded by the Gold Fields Ghana Foundation, which receives one dollar per ounce of gold produced by GFGL and 0.5% of its pre-tax profit⁶². The

programme targets the 16 communities affected by the company's mining operations (stakeholder communities)⁶¹. Agricultural projects under the SEED programme include oil palm cultivation and two fish farming projects.

The first fish farming started in 2008 at Abekoase, a stakeholder community, and involved the development of 8 fish ponds. Seven of the ponds were stocked with tilapia and one with catfish. The project involved 100 community members during the construction period and has 40 permanent employees⁵⁴. The second project is a cage culture project, involving 8 nylon netting cages on a lake at the Tarkwa mine. It was funded and developed by GFGL in 2009. By 2010, the cages had been stocked with over 50,000 tilapia fingerlings and employed one person permanently. Harvested fish from the ponds are sold at the company's canteen, local hotels and restaurants. GFGL assists in managing the fish farming projects in the early phases and intends to hand them over fully to the stakeholder communities when they are well developed and markets have been firmly established. The company also intends to establish a cold storage facility in order to expand the projects⁵⁴.

Also under the SEED programme, over 17,000 oil palm seedlings have been distributed to over 263 farmers in stakeholder communities for cultivation. The farmers are provided with technical training under the programme and have access to oil palm processing facilities provided by GFGL. GFGL intends to establish a large-scale oil palm plantation project involving one thousand hectares of land based on the successes of the oil palm cultivation under the SEED programme. However, land availability appears to be a challenge. GFGL reports over 3,000 people have benefited directly from its SEED programme and it has reached out to at least 17,000 people⁶³.

Hand-in-Hand Sustainable Alternative Livelihood Programme (Hand-in-Hand)

AGA's Hand-in-Hand sustainable alternative livelihood programme was developed in partnership with OICI in 2005. It aims at creating and supporting economic development in the eight communities surrounding the company's operations (stakeholder communities), with an estimated population of 7,500⁵³. OICI managed the programme until 2008 when it was handed over to a committee made up of members from the stakeholder communities⁵³. Agricultural projects under Hand-in-Hand include fish farming, creation of piggeries, goat and ruminant rearing, and providing support for vegetable, cassava and oil palm cultivation. The young people in the stakeholder communities are encouraged to take part in the programme as an alternative to artisanal and small-scale mining⁵³.

A co-operative for oil palm growers has been established under the programme which seeks to add value to oil palm through the cultivation of high-yielding oil palm varieties and the establishment of processing facilities. As at 2008, oil palm processing plants had been installed at Adieyie and Teberebie (stakeholder communities). Similarly, a cassava processing plant had been established at Abompuniso⁵³. In 2005, the programme provided assistance to 199 beneficiaries, who received livestock; cassava sticks, oil palm and vegetable seedlings for planting, spraying machines and agrochemicals⁵³. Two beneficiaries of the programme won the Tarkwa Nsuaem Municipality District Best Farmer award for vegetable and fish farming at the 2008 National Farmers' Day celebration⁵³.

Tano Suraw Agribusiness Growth Initiative (TAGI)

TAGI was designed by Chirano Gold Mines in partnership with African

Connections (an NGO) and the five communities affected by the company's operations. The communities are Akoti, Etwebo, Paboase, Kwawkrom and Anyinase⁶⁴. The programme aims to improve agricultural yields and enhance the income of farmers through training, access to credit facility and linkages to markets⁵⁶.

TAGI was designed based on the assessment of the communities' agricultural activities. About 75% of the economically active population in the district in which the communities are located are into agriculture. Crops widely grown in the communities include plantain, soybeans and chilli pepper. The programme was therefore to support farmers to cultivate these three crops; plantain, soybeans and chilli pepper⁶⁴. The beneficiary farmers are provided with land, loans, inputs and technical advice. As at 2009, about 500 farmers had benefited from the project. In the same year, about 120 acres of land was provided for about 600 farmers⁶⁵. The target is to reach over 1,500 farmers over the term of the programme⁵⁶.

Challenges of the agro-based alternative livelihood programmes

ALPs sometimes do not meet the felt needs of the displaced farmers. In a study in the Tarkwa Nsuaem Municipality³⁸ on the effects of mining on livelihoods, respondents were unhappy that they were presented with alternative livelihood projects, rather than being allowed to discuss their felt needs. Amongst the primary needs of the respondents was alternative land for farming that was similar in size to what they had prior to the commencement of mining operations³⁸. Others also preferred to be trained as technicians, fitters and mechanics so they could be employed into the mining companies and also have a pool of skills to depend on when the mines close⁵⁰. The implementation of a single ALP for the

affected communities without considering the diverse preferences of the people may affect the success of the programme.

High start-up costs for some ALPs deters some displaced farmers from getting involved, despite the long-term benefits⁶⁶. Even in the case where start-up capital is provided by the mining companies, displaced farmers may be deterred if the capital is insufficient, as some programmes can take up to a year to start yielding profit. For example, under the oil palm cultivation scheme of the SEED programme, beneficiary farmers were provided with oil palm seedlings, but no start-up capital to maintain the farms until the crops mature and start yielding income. The farmers were rather trained to intercrop the oil palm seedlings with staple crops, and use the proceeds from those crops to maintain the oil palm plantations. This prevented some farmers from getting involved in the scheme. Again some farmers under the livestock project had abandoned it due to the high cost of feed and drugs⁶⁷. Another study also found that the start-up funding provided by Golden Star Bogoso/Prestea Limited for its sericulture programme was insufficient, which was a setback for the programme. The programme was to take up to a year to start yielding profit, which made it inappropriate for poor displaced farmers⁶⁸.

Coupled with the high start-up cost, the earnings from some ALPs are not equivalent, especially in the short term, to what farmers earned before they were affected by mining operations. An interviewee in a study on mining conflicts in Prestea, Ghana, stated that ALPs will only be successful if the participants will earn at least what they earned from their previous livelihoods⁶⁸. The benefits are sometimes not enough to sustain families. This further deters displaced farmers from adopting them. Field studies by AngloGold Ashanti of the viability of their ALPs suggested that

the snail rearing programme did not provide enough income to sustain a family's survival⁶⁶. This sometimes forces displaced farmers into activities that provide greater short-term benefits, such as ASM⁶⁶.

The ALPs are usually aimed at preventing illegal small-scale mining, especially on mining companies' concessions, by providing alternatives to small-scale mining^{66, 68}. Agro-based ALPs tend to be one of the many options provided by the companies. They are implemented with the main aim of providing income for the beneficiaries, with the assumption that the incomes will persuade communities to adopt the ALPs rather than engaging in ASM. This may be reasons why many of the agro-based ALPs are geared towards providing economic benefits through cash crops (notably oil palm). This may explain why little attention is given to the main food crops cultivated in the Western Region, which include maize, plantain, yam and cocoyam. The agro-based ALPs also do not seem to be in line with the strategies of Ghana's agricultural development programme, as the crops under the agro-based ALPs are not the crops prioritised under FASDEP. This may have repercussions on food crop production in the mining communities as more agricultural land is used for cash crop production.

PROPORTION OF AGRICULTURAL LAND LOST DUE TO LARGE-SCALE GOLD MINING IN THE TARKWA NSUAEM MUNICIPALITY

About 31,237 km² of Ghana's land area, representing 13.1%, is under concession to mining companies⁹. About one-third of the Western Region has been leased to mining and mineral exploration companies²¹. Land use changes in three of Ghana's largest gold mining concessions will be considered. These are Tarkwa, Bogoso/Prestea and the Damang

concessions (refer to Table 3). Tarkwa and Bogoso/Prestea are exclusively in the Tarkwa Nsuaem Municipality, while Damang extends into a neighbouring district. The Tarkwa Nsuaem Municipality has a total land area of 2,354 km²⁶⁷. Table 6 shows the sizes of the three concessions and when mining started on these concessions.

Land use changes in the Bogoso/Prestea, Tarkwa and Damang concessions of the Tarkwa Nsuaem Municipality

The data used for studying the land use changes of the three concessions were derived from two studies; by Schueler *et al.*¹⁸ and Duncan *et al.*⁷¹. Schueler *et al.*¹⁸ studied land cover changes in the Tarkwa Nsuaem Municipality between 1986 and 2002 using remote sensing data and social surveys. Duncan *et al.*⁷¹ on the other hand studied land use changes of the Bogoso/Prestea concession over a 20 year period, between 1986 and 2006, using rectified raster images of aerial photographs. Though various land use types are presented in the data, the discussions presented here will focus on agricultural land use changes. Table 7 shows the classification scheme for all ground data captured in the Tarkwa Nsuaem Municipality by Schueler *et al.*¹⁸.

Changes in land use were observed in all the three concessions in the district between 1982 and 1986 (Figure 2). Agricultural land loss (shown as farmland loss in Table 7 and Figure 2) occurred in all the three concessions, with Damang recording the highest percentage loss of 54.66% (Table 8). A total of 4,935.3 hectares of agricultural land, representing 25.5% of the three concessions, were lost due to large-scale gold mining during the study period. It can also be observed that some forest lands were converted to make up for the loss of agricultural land by displaced farmers. A total of 3,066.7 hectares (15.84%) of forests were converted

to agricultural land. This, in addition to forest sites converted to gold mining pits (shown as deforestation in Table 7), resulted in a total deforestation of 6,234.3 hectares, representing 32.21% (Table 8). This confirms the findings of a study to determine the causal factors of Ghana's depleting forest resources. Agriculture and mining activities were found to be among the causes of deforestation in Ghana⁷².

Deforestation, caused by the clearing of forest lands for farming, can result in soil degradation and consequent loss of crop productivity⁷³. The Tarkwa Nsuaem Municipality lies in the Rainforest zone of Ghana and experiences high amounts of rainfall. The clearance of the forest vegetation to allow for farming may expose the soils to the high rainfall, which may accelerate the rate of soil degradation. Farmers may have to clear new forest areas for more fertile soils, which may also become degraded over time. This can result in a vicious cycle of deforestation and decline in crop productivity. This may be part of the reasons for more forest lands being converted into agriculture, particularly in Tarkwa and Bogoso/Prestea concessions.

With the exception of Tarkwa, the percentage of agricultural land lost was higher than agricultural land gained (through farmland expansion as shown in Table 7 and Figure 2) in the other concessions. Therefore though there was some agricultural land gained during the study period, there was a net loss of agricultural land by 1,868.6 hectares (9.65%) in the three concessions. This was particularly higher in Damang, with a net loss of agricultural land by 1,060.7 hectares (52.76%). A reduction in agricultural land may lead to agricultural intensification through the reduction of fallow periods. This may reduce the effectiveness of shifting cultivation as a nutrient replenishment measure, as is commonly practiced on PFA (refer to Table

7). A decrease in fallow periods can cause a decline in soil fertility and consequently a decline in crop productivity⁷⁴.

It can also be observed from Table 8 that in 1986, only 33 hectares (0.17%) of the three concessions were being mined. However, by 2002, 8,102 hectares (41.86%) more land in the three concessions had been mined. This may show that mining activities expands to more areas of the concessions over time, resulting in the displacement of more farmers. This is similar to the findings of Reisenberger⁴⁹ in a study on the effects of mining on Teberebie, a community displaced by the operations of Teberebie Gold Fields Limited (TGL) (purchased by AngloGold Ashanti in 2000). The Teberebie community lost some of their old land and some became less accessible when the community was relocated in 1991. The community however farmed on portions of TGL's concession until 2001, when many farmers were again displaced from the concession by a mine waste rock dump. Though the relocation agreement plan between Teberebie and TGL did not permit the community to farm on the land, no development had taken place on the concession and the community farmed on it without any form of resistance until 2001. It is reported that the waste dump rock destroyed 84.1 hectares of agricultural land, consisting of 248 fields, belonging to 173 households and an NGO⁷⁵. As at 2009 when the study was carried out, more agricultural land on the concession was being consumed by the waste rock dump⁴⁹.

The total agricultural land lost due to large-scale gold mining during the study period was 4,935 hectares, representing 25.5% of the Tarkwa, Bogoso/Prestea and Damang concessions and 5% of the Tarkwa Nsuaem Municipality's total agricultural land¹⁸. This figure (4,935 ha) also shows that 45.42% of all agricultural land within the concessions as at 1986, were lost due to

mining activities by 2002. Though 30.63% of the three concessions were still under agriculture as at 2002, it is threatened by future mining activities.

The study by Duncan *et al.*⁷¹ confirms the trend of decreasing agricultural land as mining related activities increase on the concessions (Figure 3). Their study evaluated 4,379.93 hectares of the Bogoso/Prestea concession over a 20-year period (1986-2006). This was the area of the concession on which land use changes had taken place. Agricultural land use decreased by 661.54 hectares between 1986 and 2006, representing a 15.45% reduction. This was due to the conversion of 325.83 hectares for mining activities (comprising mine pits and mine waste dumps) and 335.71 hectares into other land uses, including settlements and roads, as a result of the mining activities.

EFFECTS OF LOSS OF AGRICULTURAL LAND DUE TO LARGE-SCALE GOLD MINING ON FARMERS' LIVELIHOODS

The displacement of communities for large-scale gold mining operations, particularly surface mining, impacts on farmers' livelihoods^{18, 49}. Some agricultural land is lost to mining companies²⁹, as was seen in the Tarkwa Nsuaem Municipality. Attempts are made by the mining companies to provide jobs and alternative livelihoods for the affected farmers^{17, 35} and compensation is paid to them^{66, 76}. Some displaced farmers are able to get back into various livelihood activities, either through their own initiatives or through the assistance of the mining companies, whilst some remain without any form of livelihood. These effects of loss of agricultural land due to large-scale gold mining on farmers' livelihoods have been grouped into four main categories, and shown in Figure 4. They are further explained in the following sub-sections.

Agro-based livelihood activities

Some of the farmers displaced by large-scale gold mining operations are able to get back into agricultural livelihoods (see figure 4) by having access either to alternative land or through agro-based ALPs introduced by the mining companies. The process by which farmers get access to alternative land is described below.

Crop farming

Displaced farmers usually acquire alternative land through renting or clearing nearby forests¹⁸. Farmers who are able to acquire alternative land, though are able to get back into crop farming, their farming activities, including landholding status, farm size and productivity are usually affected. The loss of farmlands sometimes leads to a situation where farmers who were previously landlords become tenants and have to cultivate smaller farmlands than previously⁴⁹.

The location of alternative farmlands are also sometimes far from the resettled communities, which poses a problem for the farmers⁷⁷. In the case of the Teberebie community, the waste rock dump, aside consuming farmlands, also made it difficult for farmers whose farmlands had yet to be consumed to access their farms. Some farmers had to walk as far as 9 km to get to their farmlands. Others who are able to afford public transport go to their farms by means of a taxi. They do this once or twice a week due to the transport fares⁴⁹. In another study on the impact of Chirano Gold Mines on the fringe communities, 48 respondents (32%) reported that the company's operations obstructed accessibility to their farms, which affected carting farm produce to their homes⁷⁸. The long distances to farmlands can affect farmers' productivity through tiredness and reduced time for working on the farms. Studies have shown

that there is a positive correlation between labour productivity and agricultural productivity⁸⁸⁻⁸⁹. Reduced labour productivity can negatively affect crop productivity and yields. Transporting farm produce to homes over long distances also becomes a problem for the farmers⁴⁹.

Forests provide alternative sources of land for farming where farmlands have become scarce in the mining communities. Portions of nearby forests are cleared for farming and the felled trees are sold as firewood for income¹⁸. Shifting to new land, including forest lands, for farming can result in deforestation and soil degradation. Soil degradation can affect farmers' livelihoods through decline in crop productivity over time⁷³. Farmers may have to shift to clear new forest lands, resulting in a vicious cycle of environmental degradation and decline in crop productivity.

Agro-based alternative livelihood programmes

Agro-based ALPs provided by mining companies are another means by which displaced farmers return to agriculture. The agricultural projects under the ALPs provided by the large-scale gold mining companies include oil palm cultivation, sericulture⁶⁸, fish farming, poultry⁵⁰, vegetable cultivation, grass cutter and snail rearing⁶⁶. GFGL's oil palm and fish farms under the company's SEED project employed 110 people from communities affected by the company's operations in 2010⁵⁴. As at the end of 2011, GSR's oil palm plantation project involved over 230 small-holder farmers and 253 contract workers from the stakeholder communities⁸⁵. Challenges with the agro-based ALPs, as described in section 4.5, hinders the effectiveness of these programmes in reducing the negative effects of large-scale gold mining on the affected communities' livelihoods and food crop

production. The focus of agro-based ALPs on cash crops may also negatively affect food crop production in the mining communities if it limits access to land to food crop farming.

Non agro-based livelihood activities

Some displaced farmers are unable to get back into agriculture by not having access to alternative land for farming or engaging in agro-based ALPs provided by the mining companies. They sometimes engage in other livelihood activities including ASM², petty trading⁴⁹ and other ALPs provided by the mining companies which are not agriculture.

Petty trading provides an alternative source of income for some women who have lost their livelihoods as farmers. For example, some young women in Teberebie, a community displaced by the operations of TGL, travel to neighbouring towns such as Tarkwa to buy items including foot wear, utensils, jewellery and earrings to sell in the village⁴⁹. The other forms of ALPs provided by large-scale gold mining companies in Ghana include training in the manufacturing of batik, tie and dye and local handicraft and the production of soap, creams and oils for sale⁵¹. For example, in 2011, GSR, through GSSTEP, trained 60 people from the communities affected by its operations in masonry, carpentry and mobile phone repairs⁸⁵.

The landlessness caused by expanding large-scale gold mining has resulted in an increase in ASM^{2, 33-34}. ASM has become an important source of employment for 'otherwise-unemployed' farmers⁵⁰. The number of people engaged in ASM is believed to have increased from about 30,000 in 1995⁸⁷ to one million in 2006 (Bawa, 2006 as cited in⁹). Most ASM activities are considered to be illegal, as they are carried out on concessions leased to large-scale mining companies¹⁷. ASM also

worsens the situation of landlessness and results in environmental degradation. With the high rate of unemployment and poverty in Ghana, particularly in rural communities¹⁷, and many farmers lacking the requisite skills to be employed in mining companies³⁵, ASM provides an alternative source of livelihood for many farmers who lose their land to mining companies. It is thought that the vulnerable engaged in ASM, including women, children and the elderly⁸⁶ may abandon mining if they have opportunities to farm or engage in other trades¹⁷.

Employed by mining companies

Some of the displaced community members, including farmers, are employed by the mining companies, either permanently or on contract. The companies usually have a policy of employing a percentage of their work force from the affected local communities. An example is the case of GSR. As at 2012, 42% of GSR's 2,044 employees were from communities affected by their operations (stakeholder communities). The company's Bogoso/Prestea subsidiary also revised its local employment policy which took effect from 2012. The revision aims at recruiting 80% of its unskilled labour and 40% of skilled labour from the stakeholder communities. The new recruits are to meet set criteria to be endorsed as "community citizens" by their local leaders. This is to ensure that as many people as possible are employed from the communities affected by the company's stakeholder communities⁵². There are similar initiatives by the other large-scale gold mining companies including Chirano Gold Mines⁵⁶ and AngloGold Ashanti⁵³ to provide employment for the communities affected by their mining operations. In the study on the Chirano Gold Mines, 20 of the respondents (13%), who

were previously farmers, confirmed to have secured employment with the company⁷⁸.

Joblessness

The loss of farmlands due to large-scale mining gold has been cited as the main reason for the loss of livelihoods in mining communities⁷⁹. Displaced farmers who are unable to have access to alternative land to farm are rendered jobless³⁸. Migrant farmers and women tend to be the most affected. Migrant farmers pay to farm on stool land by renting or through crop sharing⁸⁰. They have no claims to the land they cultivate, and when the land is leased to mining companies, they sometimes do not receive any compensation⁶⁶. This may leave them with no land to farm on and affect their ability to engage in alternative livelihoods.

In rural communities, women tend to depend almost entirely on land for their livelihoods and have fewer alternatives when deprived of their land. Women tend to have a low status in rural communities²⁹ and are sometimes side-lined during payments of compensation as they have limited access to and control over farmlands⁸¹. Men also tend to be the beneficiaries of most of the unskilled jobs in mining companies²⁹. All these affect women's ability to have alternative jobs and land. This supports findings that women tend to be the most affected by the impacts of mining⁸²⁻⁸³.

Mining companies are usually accused of making promises of development, including providing jobs to the affected communities during their exploration activities, which they fail to fulfil when they start their operations^{21,38,79,84}. High expectations for employment, especially by the young men and women, when the mining companies start their operations are not met. This may be because a high percentage of mining companies' work requires substantial

technical skills, which is usually lacked by predominantly farming communities³⁵. Studies have however shown that affected community members will like to be trained in the required technical skills so they can be employed by the mining companies^{35,50}. Some mining companies, such as NGGL³⁵ and GSR⁸⁵ have made efforts to provide such skills to the displaced communities, but the beneficiaries are few compared to the number of people displaced by mining activities. This leaves many of the displaced farmers without the requisite skills to be employed into mining companies.

Surface mining operations, unlike underground mining, are highly mechanised and require less human input¹⁷. Also, the large number of people displaced by a mining company's surface mining operations makes it a challenge to provide jobs for all those affected. The first phase of NGGL's Ahafo South project displaced 9,500 subsistence farmers from their land for the construction of four pits³⁶. The company's Ahafo and Akyem operations when in full force, is expected to affect over 35,000 people⁶⁶. This is similar to the number of people displaced by mining companies in the Western Region. It is estimated that, between 1990 and 1998, large-scale gold mining displaced 14 communities in the Tarkwa Nsuaem Municipality, with a total population of over 30,000³⁷. Data available indicate that as at 2005, mining companies in the municipality had 6,414 employees⁶⁷. The activities of mining companies do not provide enough jobs to match the total number of people displaced from agriculture⁸⁴. Many of them may become jobless if they are unable to find alternative livelihoods or land for farming.

The joblessness created by large-scale gold mining operations may contribute to high unemployment rates in mining communities, particularly among young men and women. A study by the International

Finance Corporation and the Ghana Australia Goldfields Limited (GAGL) found that as at 2004, the unemployment rate for Ghanaians between 15-24 years in mining areas was higher than the national average. The rate was 70-90% in the mining areas compared to the national average of 30%⁶⁶. The continuous loss of agricultural land due to large-scale gold mining may contribute to higher joblessness in mining communities.

CONCLUSIONS

The study revealed that large-scale gold mining results in the loss of agricultural land in Ghana. The loss was found to be about half of the three concessions studied (Tarkwa, Bogoso/Prestea and Damang concessions). As compensation in the form of alternative land does not usually take place, the area lost may represent a substantial portion of the affected communities' farmlands. A trend of decreasing agricultural land as mining activities increase on concessions was also found, which implies available agricultural land may be lost in future. ALPs initiated by the mining companies to offset the effects of their operations on the host communities were also found to be hindered by challenges.

The ALPs have made some positive contributions in the host communities, including providing alternative sources of income for households. The challenges which have hindered their full success include high start-up cost, lack of proper consultation and insufficient earnings which discourages some community members from engaging in them. The agro-based ALPs have focused on plantations of cash crops, mainly oil palm, to the neglect of the traditional food crops grown in the region. Though food crops can be interplanted with the cash crops during the early stages of the plantations, as the cash crops mature, this can no longer take place. This may threaten

food crop production in the communities as cash crop plantations under ALPs increase.

The ALPs seem to be mainly aimed at preventing ASM on mining companies' concessions by providing alternative sources of income. This influences the choice of ALPs and commodities involved, which appears to be skewed towards economic empowerment rather than addressing the broader effects of the companies' operations on the mining communities. Collaboration between Ghana's agriculture ministry and the private sector does not appear to be effective as development projects implemented by the mining companies do not fall in line with the strategies of FASDEP at the district level. These have contributed to less promotion and development of the traditional food crops grown in the Western Region under the ALPs.

The effects of loss of agricultural land due to large-scale gold mining on the host communities could therefore be substantial as the ALPs face challenges which hinder their success. The effects on agriculture may include the loss of agricultural labour, reduced yields and land degradation. This can lead to high food prices in the communities. Farmers' livelihoods are also affected through joblessness and reduced income. Women and migrant farmers were found to be most affected, as they sometimes do not receive compensation. As farmers who cultivate portions of concessions face what could be a second displacement, the effects are likely to worsen as mining activities expand. The loss of agricultural land due to large-scale gold mining can affect food crop production in Ghana in the longer term, as the mining communities are also important food production centres in the country.

Further studies need to be carried out to determine the extent of the effects of decreasing agricultural land due to large-

scale gold mining on agriculture in the mining communities. This should include both qualitative and quantitative research at the community level and could be carried out by universities, mining companies, consultancy firms and government agencies. This will provide valuable data which would help in conducting a cost-benefit analysis of the impact of mining on stakeholder communities and other sectors of the economy. Knowing the real benefits and costs of mining on communities and other sectors will provide valuable input and help inform in future policy development concerning mining.

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Conflict of Interest and Funding Source Declaration

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Table 1: Food balance sheet of Ghana for 2010/2011

Type of commodity	Gross Biological Production (MT)*	Total Imports (MT)	Total Export (MT)	Total Supply (MT)**	Estimated Net Consumption (MT)	Net Deficit/Surplus (MT)
CEREALS	2,710,031	580,800	10,150	2,696,759	2,005,664	691,094
Maize	1,871,695	18,000	10,000	1,400,167	1,060,967	339,199
Rice	294,962	283,000	100	539,517	581,352	-41,835
Millet	218,952	1,800		196,878	24,223	172,655
Sorghum	324,422		50	282,197	24,223	257,974
Wheat	0	278,000		278,000	314,899	-36,899
STARCHY STAPLES	24,357,105		9,040	18,506,342	10,214,839	8,291,503
Cassava	13,504,086			9,452,860	3,703,697	5,749,164
Yam	5,960,486		9,000	4,759,389	3,027,875	1,731,514
Plantain	3,537,734		40	3,007,034	2,054,110	952,924
Cocoyam	1,354,799			1,287,059	968,920	318,139
LEGUMES	896,080	3,730	95	791,847	460,237	331,610
Groundnut	530,887	150	45	477,904	290,676	187,228
Cowpea	219,257	3,380	0	189,749	121,115	68,634
Soybean	145,935	200	50	124,195	48,446	75,749

Source: Modified from MOFA²²

* includes for human consumption, livestock feed, wastage, and seed

** [sum of total commodities available for human consumption (gross biological production minus livestock feed, wastage and seed), carry over stock (from previous year), and total imports minus total export]. Carry over for CEREALS= 86,570 MT; Maize= 81,980 MT; Millet= 4,590 MT

Table 2: Number of people displaced by the operations of Newmont Ghana Gold Limited and Gold Fields Ghana Limited

Company	Displaced people/communities	Source(s)
Newmont Ghana Gold Limited (Ahafo operations)	1,700 households 9,500 farmers	35 36
Newmont Ghana Gold Limited (Ahafo and Akyem operations)	35,000 people*	66
Gold Fields Ghana Limited	14 farming communities, with about 30,000 people	37
	20,000 people from 15 villages, including 4,000 farmers from 3 communities	38-39

* Expected number of people when company is in full operation

Table 3: Large-scale gold mining companies in commercial production in Ghana, showing their concessions and operating regions

Company	Concession(s)	Region(s)
Newmont Gold Ghana Limited (NGGL)	Ahafo Akyem	Brong Ahafo Eastern
AngloGold Ashanti	Obuasi Iduapriem	Ashanti Western
Golden Star Resources Limited	Bogoso/Prestea Wassa/HBB	Western Western
Gold Fields Ghana Limited	Tarkwa	Western
Abosso Goldfields Limited*	Damang	Western
Chirano Gold Mines	Chirano	Western
Adamus Resources Limited	Nzema	Western

Computed from Ghana Chamber of Mines²⁶. *Subsidiary of Gold Fields Ghana Limited

Table 4: Alternative livelihood programmes of large-scale gold mining companies in the Western Region of Ghana

Company	Alternative livelihood programme	Type	Source
Golden Star Resources Limited (GSR)	Golden Star Oil Palm Plantation (GSOPP) Initiative	Agribusiness	51
	Golden Star Skills Training and Employability Programme (GSSTEP)	Vocational training	52
AngloGold Ashanti	Hand-in-Hand Sustainable Alternative Livelihood Programme	Agribusiness Entrepreneurship	53
Gold Fields Ghana Limited (GFGL)	Sustainable Community Empowerment and Economic Development (SEED) Programme	Agribusiness	54
Adamus Resources Limited	Livelihood Restoration Programme*	Agribusiness Vocational training	55
Chirano Gold Mines	TanoSuraw Agribusiness Growth Initiative (TAGI)	Agribusiness	56

*Initiated in 2012. Adequate information unavailable, hence not described.

Table 5: Some key information on GSOPP

GSOPP development update	Up to date (2006 to 2012)	Source
Area planted		
GSOPP plantation	790 ha	58
out-grower plantation	Over 100 ha	58
Number of beneficiaries		
Contracted labourers	243	52
Smallholder farmers	236	52
Number of beneficiary communities	9*	59
Fruits harvested (tonnes)	3,800	52
Funding (dollars)	3.6 million	52

*As at 2010

Table 6: Size and date mining started on Bogoso/Prestea, Tarkwa and Damang concessions

Concession	Size (ha)	Date mining started	Reference
Bogoso/Prestea	5,938.7	1992	18
Tarkwa	11,408.4	Early 1980s	69
Damang	2,010.5*	1989	18

* Area under Tarkwa Nsuaem Municipality. Total concession is 8,111 ha⁷⁰

Table 7: Classification scheme for all ground data captured in Tarkwa Nsuaem Municipality between 1986 and 2002

Class	Description
Deforestation (D)	Forest sites converted to surface gold mining pits (forest cover in 1986, mining pits in 2002)
Farmland loss (F)	Regions dominated by agricultural land use converted to surface gold mining pits (farmlands in 1986, mining pits in 2002)
Permanent forest (PFo)	Areas where forests remained unchanged (land covered by forests in 1986, still forests in 2002)
Permanent mine (PMi)	Land cover constantly mined over the observation period (mining pits established before 1986, still under mining in 2002)
Permanent farmland (PFa)	Constantly used by farmers, mostly in the form of shifting cultivation (farmland by 1986, still farmland in 2002)
Farmland expansion (FaE)	Agricultural expansion into forest (forest in 1986, converted to farmland by 2002)

Source: Modified from Schueler *et al.*¹⁸

Table 8: Land cover changes between 1986 and 2002 in Damang, Bogoso/Prestea and Tarkwa mining concessions

Concession	Land use class						Sum per concession
	D	F	PFo	PMi	PFa	FaE	
Damang	51.3 ha (2.55%)	1099.0 ha (54.66%)	166.6 ha (8.29%)	5.7 ha (0.28%)	649.6 ha (32.31%)	38.3 ha (1.90%)	2010.5 ha (100%)
Bogoso/ Prestea	449.2 ha (7.56%)	1739.8 ha (29.30%)	282.8 ha (4.76%)	1.8 ha (0.03%)	2735.3 ha (46.06%)	729.8 ha (12.29%)	5938.7 ha (100%)
Tarkwa	2667.1 ha (23.38%)	2096.6 ha (18.38%)	1775.3 ha (15.56%)	25.5 ha (0.22%)	2545.2 ha (22.31%)	2298.7 ha (20.15%)	11408.4 ha (100%)
Total	3167.6 ha	4935.3 ha	2224.8 ha	33.0 ha	5930.2 ha	3066.7 ha	19357.5 ha
MCP*	16.36%	25.50%	11.49%	0.17%	30.63%	15.84%	100%

* Mean class proportion across all three concessions

Source: Modified from Schueler *et al.*¹⁸

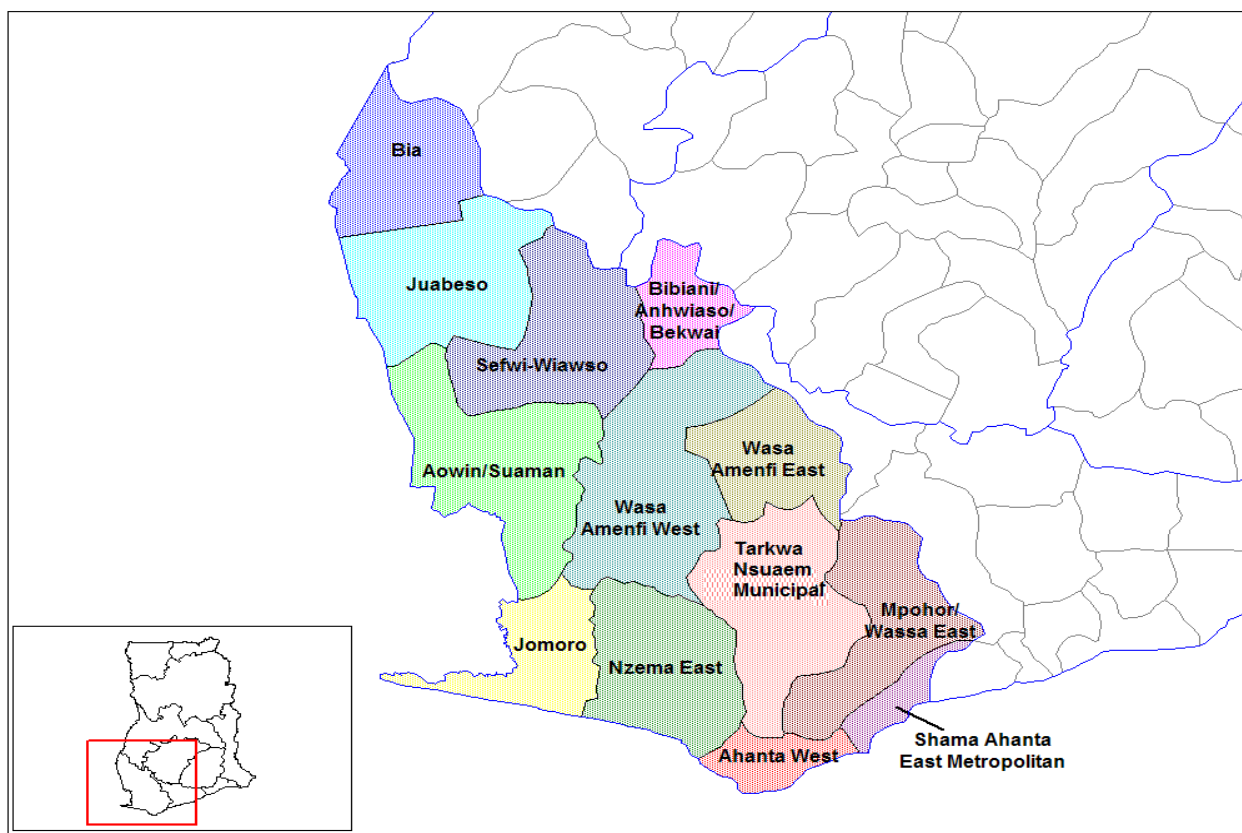


Figure 1: Map of Western Region of Ghana showing Tarkwa Nsuaem Municipality⁴³.

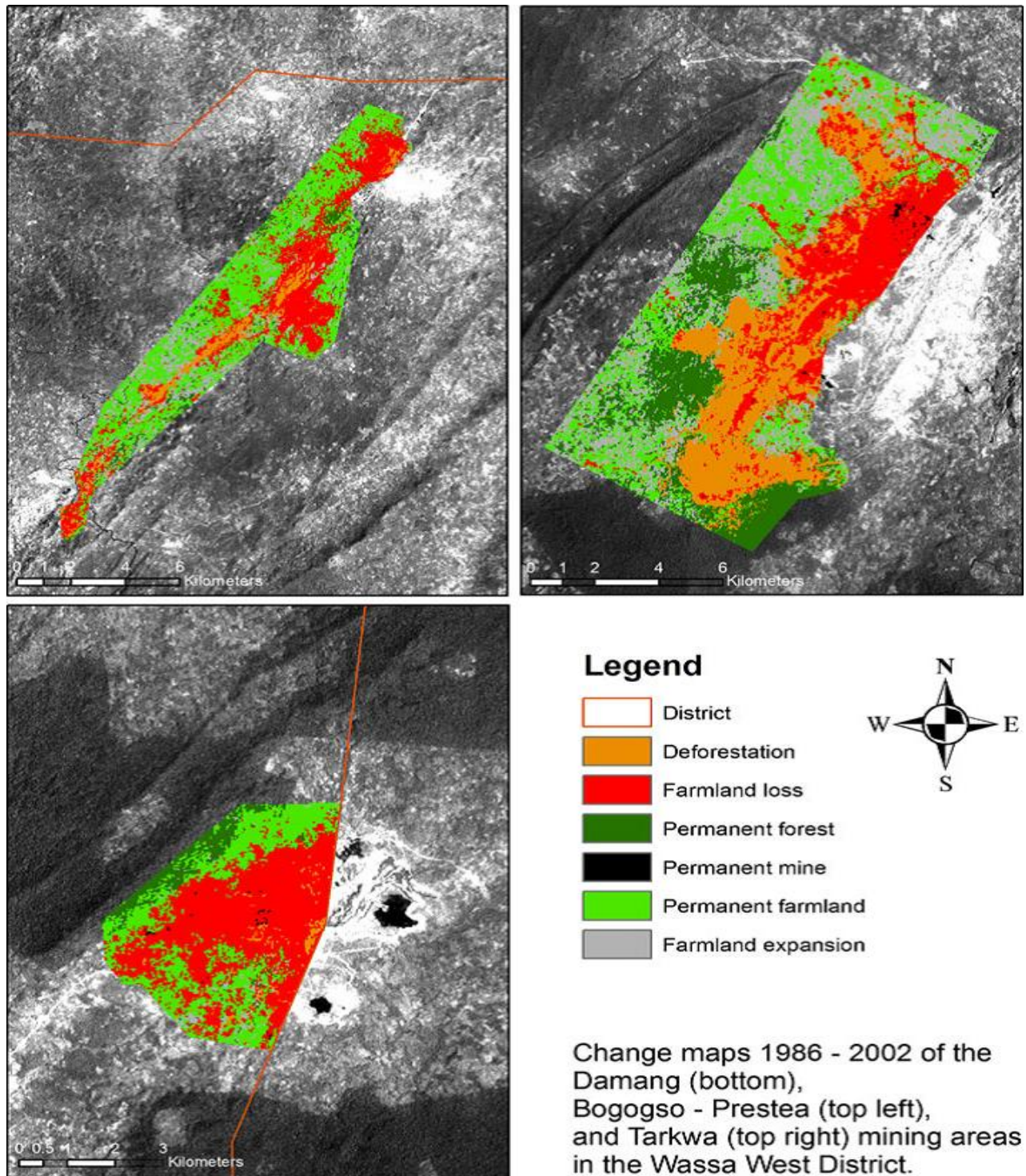


Figure 2: Land use change between 1986 and 2002 within the Bogoso/Prestea, Tarkwa and Damang concessions in the Tarkwa Nsuaem Municipality¹⁸

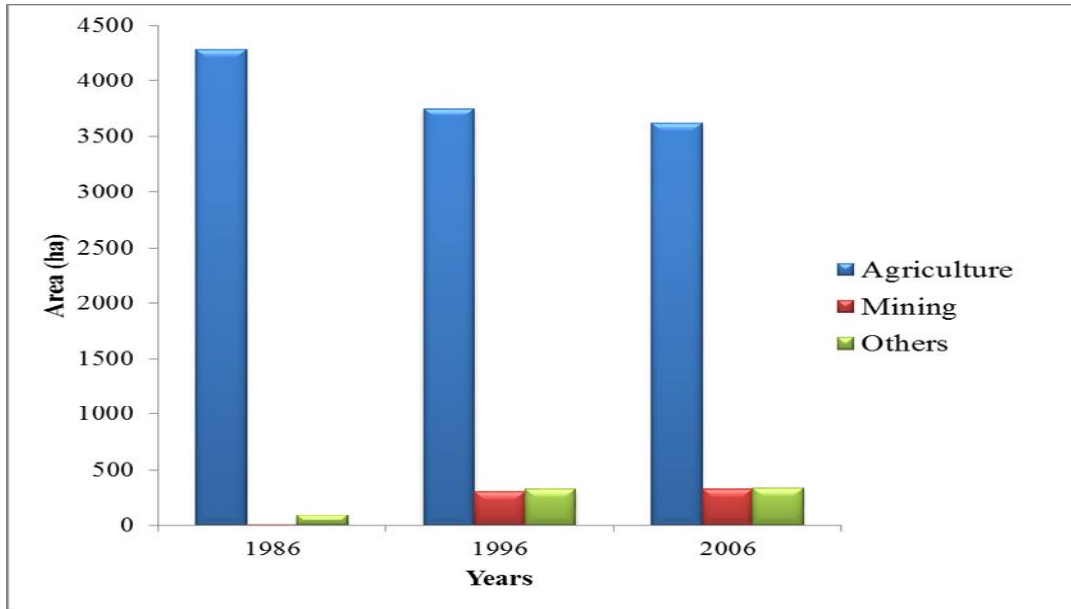


Figure 3: Land use changes due to mining as against agriculture and others⁷¹.

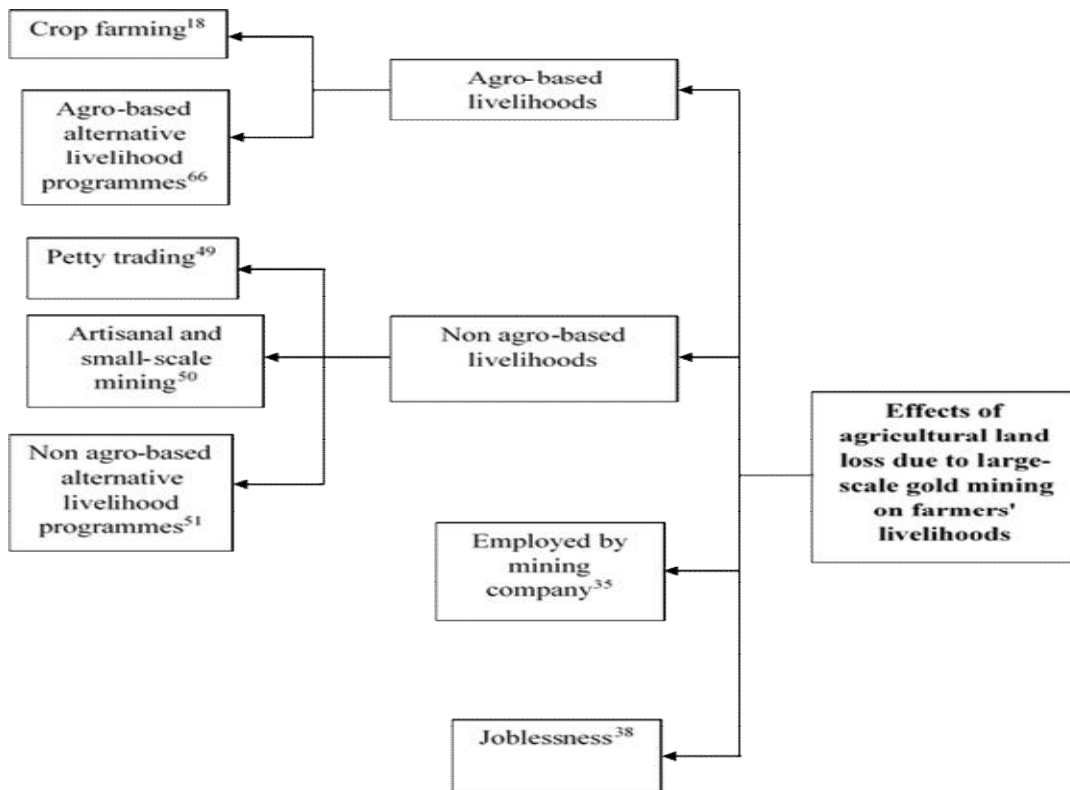


Figure 4: Effects of loss of agricultural land due to large-scale gold mining on farmers' livelihoods