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THE DEGRADED SAND MINING SITE AT GOLINGA, NORTHERN GHANA

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ABSTRACT

This research work was concerned with the relations between land use rights and degradation. A case study is presented of a sand and gravel mine site in northern Ghana, where commercial mining activities have replaced previous use of the land for crop production and grazing. The practice leaves behind open pits on the land surface, enlarged by wind and water erosion due to loss of vegetation and topsoil. These pits are used as refuse dumps by waste management companies, which exacerbates the effects of the site's degradation to the surrounding communities. Specifically, this study aimed at measuring the total size of the mine area left bare, identifying the reasons for land use changes, and investigating the effect of degradation on the living conditions of local people, taking gender into account. Most importantly, this research explored whether traditional and/or modern land tenure arrangements have contributed to the degradation of the area and whether relevant institutions have the capacity to contribute to the reclamation of the land. The study was undertaken from March to September, 2016. GPS coordinates were taken for the site, interviews were conducted and secondary data obtained. The current size of the mine is 97 hectares. Farmers who lost their farmlands were not compensated and most of them have been rendered jobless, with associated problems. The findings revealed that traditional land systems within the area interfere with environmental regulations and procedures. No reclamation plans are in place to enhance the recovery of the area. The author therefore recommends that sand and gravel mining should be paid much more attention by appropriate authorities and that even distribution of benefits to affected stakeholders is ensured. Additionally, the author recommends that the previous users should be empowered to demand reclamation of the land.

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1. INTRODUCTION

One of the anthropogenic modifications of the Earth's land surface with the greatest impact is land use and land cover change (Lambin et al. 1999). This includes, among other things, the extraction of surface material. Such changes often result in degradation of soils and biota. However, the degradation process can be reversed under some circumstances, although it takes some time to recover previous biodiversity (Mertens & Lambin 2000).

Sand mining, which in Ghana is referred to as 'sand winning', is the collection and transport of fragments of sand and gravel as raw material for construction of roads, bridges and built facilities for accommodation or other purposes. Sand and gravel are thus important basic materials needed for concretization in construction across the country. For construction purposes, a grain of sand with the diameter range between 0.002 and 0.08 is extracted with gravel sizes from 0.08 to 4 inches (Peprah 2013). The processes involved in sand winning damage the soil profile and its surface. These changes affect the topography of the land as well as contributing to its degradation (Mehta et al. 2007).

Golinga is a town in the Tolon district of the Northern Region, Ghana (Fig. 1). It is located in an area endowed with soils of the sandy loam type in large amounts (Soil Research Institute 2010). Most of the area was previously covered with grasses, farmland and woodlots. Some portion of this has now been converted from its former use for crop production and grazing into commercial sand mining activities to serve construction purposes. In terms of the definition given by Millennium Ecosystem Assessment (2005) of land degradation as the decrease in the quality of land with loss of biological or economic productivity as a result of natural and or human activity, Golinga and its surroundings have suffered from biological loss on a portion of land due to the human activities of sand mining.

A study carried out by Imoro et al. (2012) on soil productivity in the Tolon Kumbungu district indicated that the soils in Changnayili, a village part of the degraded sand mining area selected for this research project, are less productive than those in the land of the communities selected for comparison with regards to agricultural purposes. The authors concluded, however, that, with effective management practices and possible addition of nutrients, the land could be again made productive. The area seems more depleted, but even so, some restoration could be possible in the case of this degraded sand mining site. Commercial sand mining in the Golinga area involves clearance of the top vegetation to get access to the underlying sandy soil and gravels. The topsoil is almost gone, leaving the land bare, with some formation of hardpan. This practice has left behind open pits on the land surface, which are enlarged by wind and soil erosion due to the loss of vegetation. In an attempt to make use of these pits, waste management companies from the nearby city of Tamale dump waste into them. The stink emanating from this is unbearable to nearby communities. New areas are continuously being cleared. It seems that nothing is being done to enable the recovery of the land.

This research project explores issues relating to this site, which has been left bare and unproductive due to the loss of vegetative cover and topsoil. In broad terms, the study examines how land use rights influence degradation. It also addresses the following research questions:

- What is the total area of the land left bare?
- What are the reasons for why sand mining has replaced earlier land uses?
- What is the influence of the degradation on the living conditions of local people, taking gender into account?

- Have traditional and/or modern land tenure arrangements contributed to the degradation?
- Have the relevant institutions the capacity to contribute to the restoration of the land?

Answers to these research questions provide baseline knowledge that can contribute to the search for solutions that not only must prevent further degradation, but also contribute to the restoration of productivity on the land already affected. The study is intended to draw attention of the relevant institutions – the Tolon District Assembly and the Environmental Protection Agency – to the process of degradation in the study area, and to enhance further monitoring action to be considered with restoration options. The findings are also going to be of interest to other researchers working on similar degradation issues.



Figure 1. Map of Ghana, showing Tamale and the mine site within the Northern Region. (Map by Karl Benediktsson).

2. BACKGROUND AND LOCAL CONTEXT

2.1 Urban growth and land use change

The expansion of cities with population growth is accompanied by an increase in food consumption and developmental amenities, including road construction and infrastructure expansion. Land becomes the primary source of resources that are modified to satisfy these needs in most cases (Karg et al. 2015). Land provides minerals from below its surface, soils and diverse vegetation types. Tamale is the capital of the Northern Region of Ghana and the nearest city to the study area. The population of Tamale is currently close to 400 thousand, and has been growing at a rate of approximately 3.7% per annum since the year 2000 (Ghana Statistical Service 2000, 2012). Tamale has experienced a boom in various economic sectors, such as banking, education and health which involves construction of new buildings, creating more demand for sand. In the education sector, new schools at all educational levels have been built by the government within and near the city of Tamale, accompanied by boarding facilities. Similar developments have occurred in the health sector as well, in recent years.

Naab et al. (2013) describe Tamale's high growth rate as a combination of swift advancement of industrialization, and the profligate increase in population. Consequently, changes in land uses have occurred, notably with the reduction of land used for agricultural purposes in order to satisfy residential accommodation needs and other infrastructural expansion. Different types of natural resources are exploited by the city from urban peripheral villages. Agricultural lands in and near the Tamale metropolitan area have also experienced land use changes as a reflection of pressures from the urban area (Naab et al. 2013). Studies carried out by Braimoh (2004) show that land change developments in northern Ghana concurrently results in both the expansion of built structures and a rise in agricultural production. However, this study brings to light that an activity such as sand mining is also on the upsurge, reducing crop production in some areas.

2.2 Degradation, livelihood and gender

Worldwide, families living in rural communities, experience adverse effects from ecosystem degradation to a greater extent than other household classes. This is because job opportunities are limited in rural areas, where the population tends to depend more on natural resources (World Resources Institute 2005). Poverty levels and the effects of poverty within Ghanaian society differ according to geographical region, age of an individual, occupation and gender. Poverty is more concentrated in the northern savannah part of the country. Within these areas, that cover more than of 70 thousand km², between 69% and 88% of the population are estimated to live in poverty, with women outnumbering men (Government of Ghana 2003). Workers engaged in agriculture have lower incomes, and women among this working class obtain less income every month compared to men (Ghana Statistical Service 2012). The reasons for women being more exposed to poverty than their male counterparts are linked with the cultural practices of not giving women equal access to production resources such as land. Productive land sizes are normally apportioned to men for cash crops before women are considered (Awumbila 2006). In order to support themselves, women in the Northern Region pick fruits from indigenous trees such as shea nuts from the shea tree (*Vitellaria paradoxa*), locust bean or dawadawa from the parkia tree (*Parkia biglobosa*), as well as non-indigenous tree species like mango (*Mangifera indica*) to support their incomes. These secondary income sources are reduced when portions of vegetation on the land are rendered bare. This is revealed by Awumbila (2006), who stated that when such an area is degraded, limited land available for

production would be competed for by the men who would obtain larger portions, leaving women with little or nothing. As productive farmland is reduced, life becomes tougher for women. Land use change from farming to open refuse dumps can expose communities to the prevalence of cholera, especially women and children (Osei & Duker, 2008).

2.3 The administrative structure of Ghana

The Republic of Ghana is divided into ten administrative regions. Each of these is subdivided into districts, which are the second-level administrative subdivisions beneath the regional level (Government and Politics 1994). In all, there are 216 districts in Ghana. The Northern Region has 26 districts, one of which is the Tolon District (Local Government 1993). At the district level, the district assembly is the highest administrative authority. It is referred to as the local government. The 1992 constitution of the Republic of Ghana, gives a mandate to local governments, assigning them deliberative, legislative and executive powers (Local Government 1993).

The District Assembly (DA), headed by the District Chief Executive and staff members of differing expertise, sees to the development of its jurisdiction in all aspects. It is recognised as the planning authority for the district in the national constitution, among other duties. In 1994, the Environmental Protection Agency (EPA) was formed to work hand in hand with the district assemblies on waste management, pollution of all kinds, deforestation and degradation of natural resources (Environmental Protection Agency 1994). The EPA is responsible for assessment and granting of environmental safety permits for projects or activities suspected to have an effect on humans or the environment as a whole.

In the administrative structure of Ghana, chieftaincy is part of local governance but there is no clear definition of the role of chiefs in the local governance unit. Chiefs have been active in local government functions involving local development under the Native Authority System from the period of colonial rule until the present day (Ayee 2007).

2.4 Land tenure in the Northern Region

According to Yaro (2010) the Northern Region of Ghana is primarily used for agricultural production. Hence land is the most vital resource for livestock feed, food production and other natural resources for individual and family livelihoods. Matters involving land are of great interest in this area, particularly in the Tolon District where between 80% and 90% of the population are peasant farmers (Ghana Statistical Service, 2010). As in most other African countries, agriculture, natural resources and other land-based activities are fundamental to livelihood and land is held in high esteem as an asset in such societies (Quan 1997, Ellis 2000). During the colonial era, anthropologists, using established frameworks with resources of information available to them from tradition, identified two broad traditional systems of land ownership in northern Ghana, centralized and acephalous (Pogucki 1965). The centralized system of landholding includes the ethnic groups Dagomba, Mamprugu, Nanumba, and Gonja in the Northern Region. A community may have a combination of two or more of these tribes in the villages where customary land ownership prevails. The study area for this research is settled mostly by the Dagomba people.

With regards to access to land, the clans and tribes belonging to the centralized system recognize their right to land through first migrants or settlement and warriors who fought during conquest (Pogucki 1965). The right is passed on to descendants of these families as true royal

owners of the land. The title of chiefs represents the paramount traditional kings, under which there are sub-chiefs. However, the management of the land is as well the responsibility of the chiefs and sub-chiefs. There are nine sub-chiefs in the Tolon District. Traditionally, the chiefs have much power and reside over the activities that have to do with land in the northern communities. Chiefs possess the authority to sell land or grant permission or give right to community members or investors to make use of a particular piece of land for various activities. For instance, a sand mining company may seek permission from the chief and with his consent the activity can start. However, issues regarding environmental safety to humans and biodiversity are supposedly handled by formal authorities in Ghana, such as the Environmental Protection Agency, and the Environmental Department of the District Assembly (Environmental Protection Agency 1994).

There has been ambiguity among community developers in Ghana about whether traditional systems are capable of adapting to emerging situations regarding land use access and the environmental laws of the country (Ubink & Quan 2008). Individual families own land and make use of it in a customary way and in most cases no formal documentation covers this ownership of land. Customary land tenure procedures are considerate and compromised to conform with changes in needs of the people in society. This system is regarded to be very supple and negotiable (Berry 2009).

In the northern part of Ghana, customary land tenure affairs are seeing a new paradigm shift in areas where the need to satisfy accommodation and other infrastructural expansion clashes with agricultural purposes, given the limited arable land that is available (Abdulai 2002). Sale of the land for building purposes is lucrative for the chiefs and landowners and in most cases this overshadows the preference of the rural populations' use of the land for subsistence farming. Under most circumstances, chiefs try to increase the sources of revenue they get to support their livelihood whilst maintaining power and recognition in the community as a wealthy king or chief. However, in the absence of efficient ways to create checks and balances, the traditional system compromises on most issues regarding land due to the attractive market demand for land by influential individuals at the expense of the poor in the society (Yaro 2012). The Environmental Protection Agency of Ghana and some other non-governmental organizations for environmental protection in the country sometimes intervene in land degradation problems, although they have only limited power to enforce the law.

3. THE STUDY AREA

3.1 Communities

The study area encompasses three communities: Golinga, Galimkpegu and Changnaayili (Fig. 2). Golinga is the largest community. Socially, there are no distinctions in the way of life among the people from these three communities that surround the mine. They speak a common language (Dagbani). They belong to the Dabon kingdom. In terms of hierarchy, village chiefs are under sub-chiefs of towns or cities within Dabon, and they are all subservient to a Paramount Chief or king, referred to as *Yaa Naa* at Yendi. Farming is their main occupation. Mainly there is a dispersed type of settlement, with houses built out of mud and roofed with thatch. In terms of population, Golinga has about 400 inhabitants, and both Galimkpegu and Changnaayili have below 300 inhabitants each (Environmental Officer, 30 June 2016, Tolon District Assembly, personal communication).

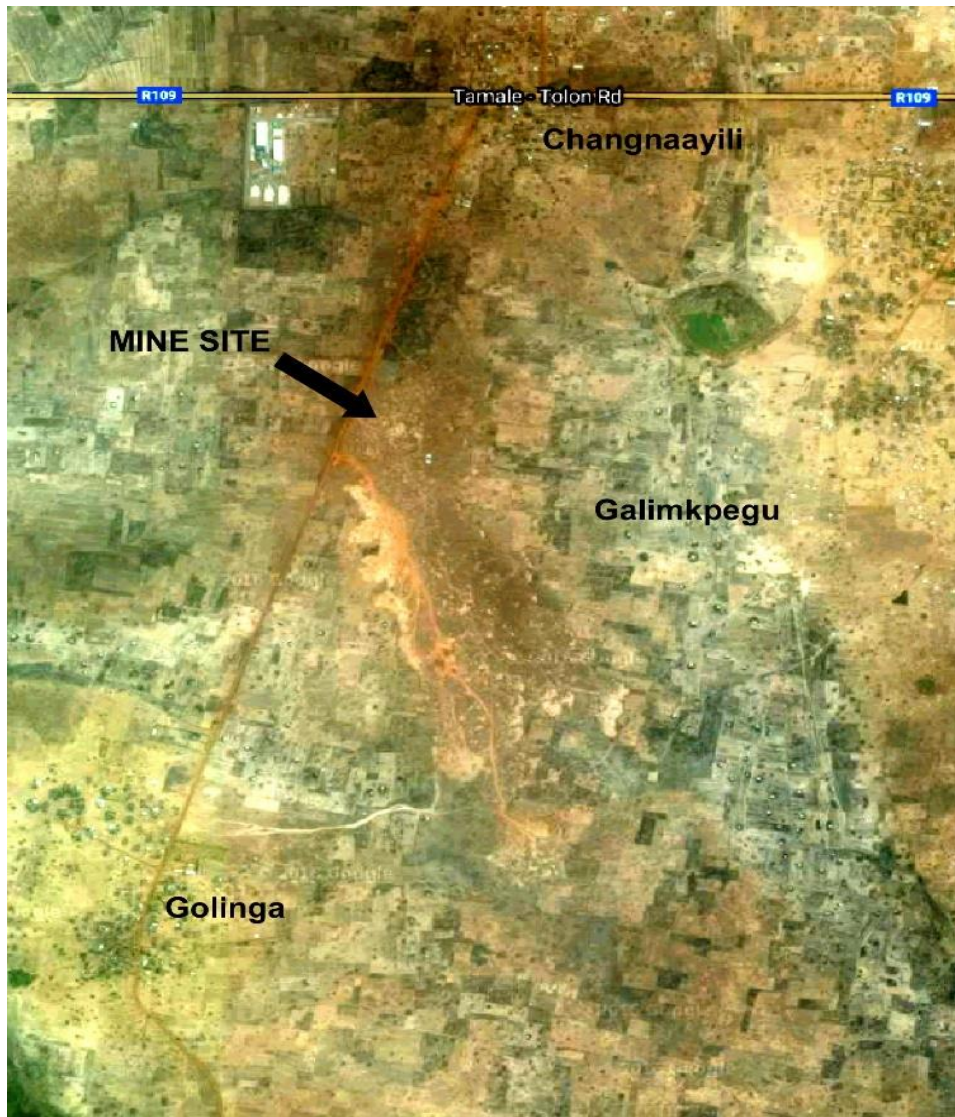


Figure 2. The mine site in 2015 showing the main Tamale–Tolon road with the names of surrounding communities (Image from Google Earth).

3.2 Natural conditions

The area has one rainy season which starts in the month of May. Rainfall is intense only for three months, July – September. The average annual rainfall is 750 to 1050 mm and the temperature for the area annually ranges from 28°C to 39°C (Ghana Meteorological Service 2014). The season starts in November and lasts until March. The northern part of Ghana is drier than the southern part, with a strong northerly wind (harmattan) prevailing during the dry season due to its proximity to the Sahel and Sahara.

The type of vegetation is savanna or woody grassland with drought-resistant trees such as neem (*Azadirachta indica*), baobab (*Adansonia digitata*), acacias (*Acacia longifolia*) and shea (*Vitellaria paradoxa*) (Fig. 3). The topography is mainly flat surfaces with the alluvial plain land form type. The land has a gentle slope and slight depressions in some parts. There are visible signs of erosion on the site.



Figure 3. A typical savannah vegetation of the area not mined (left) and an image from Golinga after mining (right). (Photo to the left from Forestry Commission of Ghana 2010 and to the right taken by the author, 10 March 2016)

Research carried out by the Soil Research Institute (2010) on the soil at Golinga indicates that the area has brown sandy loam topsoil with a granular structure. The soil contains fine dry sandy soil of large pore with lots of gravel. The subsoil is light yellowish brown sandy to loam with sub-angular blocky structure with clear cut boundaries with a few fine roots in the soil. The sub-soil contains more gravel than the top layer.

4. METHODS

4.1 Site observation

Some knowledge of the physical properties of the mine site and the study area as a whole were obtained through direct observation by the field technicians and the author. Photos were taken at the mine site for comparison and judgments (Fig.3).

4.2 Measurements

The area of degraded land was estimated with the help of field technicians, using a handheld GPS device. Coordinates were taken along the boundaries of the mine site (Appendix 1). The GPS coordinates of resulting points were imported into the QGIS geographic information software and plotted onto a remote sensing image of the site by the supervisor. The area of the mine was calculated with QGIS.

4.3. Interviews

To understand the social order with regards to land use practices, structured interviews were carried out to provide qualitative data on reasons why earlier land uses changed, the effect of this change on local livelihoods, and issues regarding land rights (Appendix 2). Snowball sampling, or the referral method (Gubrium & Holstein 1997), was used to select male and female adults from the three communities for interviewing. Following this method, the first

interviewed farmer recommended other land users for interviewing, whose portion of land was affected by the sand mining, and so on.

The age of the men interviewed ranged from 25 to 68 years while the age of the female respondents ranged from 19 to 70 years. The major occupations of the men interviewed were, in order of the most dominant source of income: farming, grass roof thatching, petty trading and artisan work. The women mentioned shea butter processing, rice processing, farming, petty trading and artisan work as their major occupations, also presented in the order of the most dominant source of income. More than half of the male respondents had no basic education. Four of them had completed basic education while two of them dropped out of school at the basic level. Almost no woman interviewed had any formal education with the exception of one woman who had completed basic education.

The method of purposeful sampling is a good way to reach a specific group of interest (Bryman 2004), and it was also used in this research, to interview the chief in each of the three communities, an officer in charge of environmental issues in the District Assembly and an officer from the Tamale office of the Environmental Protection Agency (Appendices 3-5). The interviews were carried out from July 5th to August 8th, 2016. The interviewers were four research assistants from the University for Development Studies, two women and two men. Audio recordings were taken during the interviews. The responses from the interviewees from the communities were in Dagbani which were translated into English by the interviewers, who were bilingual. However, interviews obtained from environmental officers from the EPA and DA were conducted in English.

In all, 37 people were interviewed, 16 women and 21 men. Out of this total number, three men were the chiefs, one environmental officer at EPA, and one environmental officer from the DA, both male. Due to the sensitivity of some of the responses given, the names of the interviewees were replaced with fictional names for direct quotations in the text. However, the gender, age and occupations were not altered.

5. RESULTS

This section presents field data obtained by taking land size measurements and the various responses obtained from the villagers and the environmental officers interviewed.

5.1 Total area of the land left bare

The total size of the sand mine at the time of the GPS survey was calculated as 97.4 hectares. The remote sensing image below (Fig. 4) was obtained from overlaying the plot of the area demarcated by the GPS coordinates onto a remote sensing image.

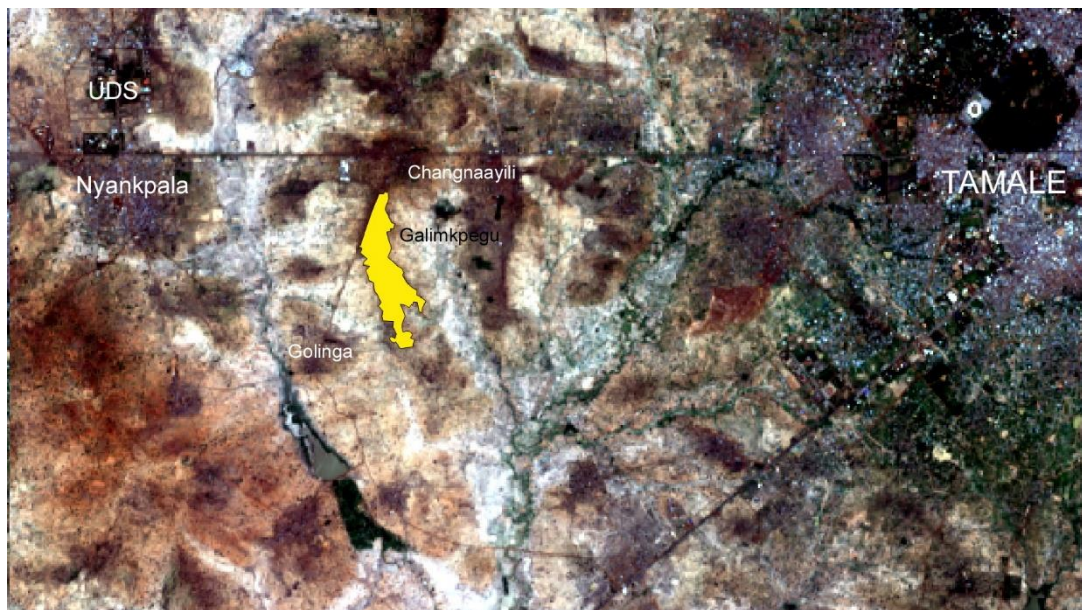


Figure 4. Mined area according to GPS surveying in July 2016 (yellow) with names of neighboring communities and urban settlements (Produced by Karl Benediksson, 4th August 2016).

5.2 Land tenure arrangements

It was shown from the responses obtained in the interviews that all three communities practice the centralized type of land ownership. The first settlers are considered as the royal family, from which the ordained chief is selected and chiefdom is inherited by his descendants. According to the chiefs they own the land, as one of the chiefs explained in these words:

“I, the chief of this village, am regarded as the owner of all the land belonging to the boundaries of this village. Anybody who wants a portion of it must come to me.”

There was no objection from any interviewed member of the villages involved to the assertion that the land was owned by the chief of the village. It is the description of how to obtain access to use a piece of land that differs. A majority of the land users had gotten the permission from the chiefs but some also held it through inheritance (family farmlands that had been passed down between generations). A few others also got access to farmland by asking friends, who had enough land, for permission to make use of a portion. The married women admitted that their portions of farmland had been allocated to them by their husbands. According to the respondents, non-community members can also have access to a piece of land by going to the chief, but normally they should be accompanied by a community member. However, they can equally ask a friend who has access to land for a share of his or her own farming land.

The chiefs revealed that although they give permission to people from their village to use a part of the land for farming, as well as to non-natives, there is a king over a larger traditional area which their villages fall under. It was revealed again that these three chiefs pay allegiance to the Sagnarigu *Naa* (Sagnarigu Chief) who is of a higher traditional authority. Sagnarigu is a part of the Tamale metropolis, now designated as a separate district. According to the village chiefs, the Sagnarigu Chief intermediates between the village chiefs and the paramount king of Dagbon, the *Yaa Naa* at Yendi. The chief of Sagnarigu, which is located next to the Tolon

District, can at any point in time give a piece of land for use in any of these three communities, as in the case of the sand mining contracts.

5.3 Previous land uses and reasons for land use change

The survey recognized that the abandoned sand mining sites where the activity is ongoing now, were farmlands before mining started. The crops the farmers mentioned that they used to cultivate on this land included maize, yam, groundnut, cowpea, vegetables and any other crops of the farmers' own interest that the land could support. Cereals, tubers and different kinds of vegetables were cultivated by the farmers during the farming season. Both women and men participate in farming. On average, farmers worked with four acres (two hectares) of land. They added that, apart from farming in the area, there were many shea nut trees on those farms, the nuts of which were picked by the women and processed into shea butter. Traders purchase the shea butter from the women. Probing further into what the land was used for before mining activities, most farmers acknowledged that shrubs, branches of trees and crop residues were obtained from the land to feed livestock and for the use of fuelwood for cooking.

Several different responses were obtained from community members regarding the reason for why the farmlands were taken away from them and converted into a mine site. The first reason was because the chiefs from whom they obtained the land for farming on leasehold found the sand and gravel mine more lucrative. Farmers whose land was affected said in confidence that the chiefs obtain good returns from the contractors in monetary terms. Abubakar, a 35-year old farmer at Galimkpegu who lost eight acres out of ten acres of his farmland to the mining activities, explained with these words:

"I know the amount of money a contractor will pay to the chief to have access to the land. I, a poor farmer, cannot raise it in years. After all, I only present small portions of my produce during harvest as gifts to the palace, so obviously he would consider the contractor."

The type of soil and gravel found in the area was also mentioned by the farmers as a reason why that area was chosen for the mine. From their experience, they said that this type of sand with gravel is good for construction purposes because it gets drier during the dry season because it contains less organic matter. According to the farmers, the soil type with gravel was not a hindrance to cultivation of crops suitable for the area, since cultivation is done during or close to the rainy season.

However, the chiefs themselves did not associate the reasons given above with the land use change. Rather they referred to the area as having been chosen for mining by the traditional area chief at Sagnarigu.

5.4 Benefits from sand mining

Although community members claimed that they had no idea about the amount of money paid by sand mining operators, they believe there was some amount of money involved that went only to the chiefs. No compensation has been given to the farmers who have lost all or portions of their lands to the sand mining. The study indicated that there were no royalties or projects of any kind initiated by the contractors that benefited the whole communities. The contractors and their workers, such as truck drivers, loaders and operators of other equipment, were all from Tamale. No community members were employed since they did not have the expertise to

operate the machines used. Actually, all the chiefs mentioned that the Sagnarigu chief received an amount of money from the contractors and some part was given to him which he distributed among affected farmers. Nevertheless, a compilation of responses showed that none of the respondents confirmed receiving such benefits.

5.5 Effects of the sand mine on individuals and families

Several side effects were raised by the people who live in this area. The first point, which almost all the respondents mentioned, was the reduction in the income levels. The main occupation of the villagers was farming. They lamented that the conversion of their farmlands into a mine site had rendered most of them jobless, having to depend on family members and friends for survival. The farmers who still had a part of their farmlands to use or parcels elsewhere complained about the substantial reduction in the quantity of produce they harvested since they had lost much of their land. Issahaku, a 55-year-old man, who was a maize and legume farmer, explained his loss of income with these numbers:

“On an acre of land, I harvest 5 bags of maize. I sell each bag at 700 Ghana cedis. Multiplying this amount by 5 will be 3500 cedis. Losing 4 acres of land now means losing 3500 times 4, each farming season now.”

This was not different from the sentiments shared by farmers who grew other types of crops as well. It was also mentioned by the farmers that there had been frequent land disputes among farmers since the start of the mine due to the land scarcity for the farmers in these villages.

The sudden reduction in income had also affected the food eaten by these farmers and their families' satisfaction as well. They explained that they often had to opt for cheap carbohydrates like maize and ate less or no meat, which was less affordable.

Some affected farmers migrated to other communities to farm. Asking for farmland from other villages comes with obligations, like giving a percentage of the produce harvested to the owner of the land from whom the farmer has obtained a portion. Some farmers referred to this as belittling their pride in the eyes of the villagers they beg land from, outside their own village.

Besides the aforementioned problems, there were issues with health raised by the community members, concerning the increased number of flies in their homes from the waste dumped at the mine site. These they say makes relaxing outside sometimes unbearable. According to them, the flies settled on their food, especially when kids ate outside and they associated that with frequent illness among children. The sign of this was seen in images of photos taken at the site after a short period of rains during the period of the research. Dark liquid with a pungent smell leaked from the heaps of refuse after rain had fallen (Fig. 5).



Figure 5. Heaps of refuse at the mine site (upper), and dark liquid seeping from the refuse (lower). The refuse was dumped by waste management companies from the city of Tamale (Photos by Awal Rashid, 4th July 2016).

Flood pathways into adjacent farmlands were mentioned by about half of the farmers who have farm land near the mine site. According to the farmers, runoff from the bare ground at the sand mine site, which destroys crops, has become rampant recently. Some farmers mentioned that the gullies created by the runoff were getting widened each day and that that called for concern. Apart from the water runoff channels, the farmers also added that the pools of floodwater now served as breeding grounds for mosquitoes, which they say made them experience mosquito bites more often and increased the number of cases of malaria. They stated that children are more susceptible to mosquito bites that leads to malaria.

Hafiz, a 39-year-old man who was also a maize farmer, mentioned that the amount of water that had found its way onto his land as runoff from the gullies near the farm was unbelievable to him. The situation, according to him, was getting out of hand, and as a result he lost most of the crops he had planted during that year's farming season. Hafiz said there were certain soil management practices he had been applying over the years, including contouring, but in his opinion, until there was a more sophisticated approach at the mining site to prevent flooding, it would be very difficult for a farmer to predict the direction of the runoff or avoid floods. He was not sure of the future of that farmland if conditions remained as they were now, for subsequent years. He did not know or suggest what could be done to help stop the flood's encroachment. Images of Hafiz's farm (Fig. 6) were taken to throw more light on his account. Pools of water formed after rainfall in the pits created by mining (Fig.7) are frequently reported as a main issue.



Figure 6. Gullies formed on farmlands adjacent to the mine site. This gully on Hafiz' farmland is in the path of the runoff from the mine (Photo by Awal Rashid, 7th July 2016).



Figure 7. Pools of water formed after rainfall in the pits created by mining (Photo by Steven Ali, 12th July 2016)

5.6 Livelihoods and gender

In the households where the head of family or husband lost acres of land, wives no longer had farmland they could call their own. The income the women used to get from the sales of shea nuts was now cut off. The female respondents whose main occupation was shea butter processing disclosed that they had had to change their business. Since the shea nut now had to be purchased rather than collected from their own farmland, they made little or no profit. Some had taken up petty trading, or rice processing if their spouses had enough money to set them up in alternative businesses. Cooking family delicacies has also become more difficult than before, as the women put it. Amina, a 26-year-old housewife stated:

“My husband still gives me the same amount of money for housekeeping. At first I used to pick most of the vegetables I planted myself from the farm to support cooking but now no one farms for vegetables. I have to buy every ingredient with the same amount which is not enough. Everybody in the house still expects the meals to taste nice and that is my own problem.”

This occasionally brings some friction between wives and husbands, when the women are blamed for meals they term “tasteless”.

The women also revealed that the daily household chore of sweeping the compound, which is solely the task of women, had become more onerous, as strong winds would blow light plastic waste from the mine site and deposit it near their homes.

5.7 Farmer reactions to land use change

According to the farmers, they had not made any formal written complaint about the adverse impact of the mining on their lives, but they said that they have expressed their displeasure at several community meetings. Enquiries about the farmers’ perception of the state of their land shows that they perceive the land as degraded. There was no response from the farmers on attempts to restore the land. They perceive nothing useful can be done. They described the state of the land in their own understanding. This was the answer obtained from Ayesha a 39-year-old, woman, on what she perceives of the state of the land:

“I don’t think that piece of land can be used for anything again. The sand on which we grow the crops is finished, how can we plant on the hard surface left?”

The evidence of the hardpans formed is seen in photos of the site taken by the field technicians during the period of the interview (Fig. 8).



Figure 8. Hardpan formed on the land surface, rendering the land unusable for cropping, (Photo by Awal Rashid, 4th July 2016).

5.8 Modern authority and culture

The environmental officer, who has worked with the Environmental Protection Agency for many years, made it known that the sand winners had never received a permit from their agency. A similar response was obtained from the person from the District Assembly at Tolon who was interviewed. The officer was aware of the sand and gravel mining in the area, but did not know when the mining had started. The institution had no data covering the site. However, he referred to an existing law that requires sand and gravel miners, parties engaged in gold or any other kind of mineral mining in Ghana to undertake measures that ensure the reclamation of the land which they mined. He explained that the right given to land users that fulfil environmental requirements by their agency is recognized as “permit to proponents of land use” after an environmental assessment. He said, however, that only land-owners have the right to land use and the transfer of that right to others. Furthermore, in his submission, he referred to the subsection on Mining under the Environmental Assessment Procedures section in the Environmental Protection Agency Act of 1994. This act gives authority and responsibility to the agency to undertake an environmental impact assessment, issue permits, monitor and ensure reclamation after mining.

The Environmental Officer referred to issues regarding land ownership in the Northern Region as “a very delicate issue”. He compared the northern and southern parts of Ghana regarding the application of environmental laws and regulations. According to him, it is much easier in the south to ensure that correct procedures are followed because individuals own land and are responsible for it. The issue is more complicated when it comes to the north, where land-related

powers lie in the hands of the chiefs. With regards to monitoring, he explained its impossibility since the contractors are not registered and receive no permit from them in the first place. He revealed that in most cases it becomes very difficult to interfere in the activities of contractors, who have the full backing of the chiefs. In extreme cases, he said, the contractors and land users that cause pollution are sued before the court of law by the agency, but this requires extra financial resources. In his opinion, this part of Golinga was “degraded”. Similar questions were posed to the officer from the DA and he also admitted that the district has not taken any drastic decision regarding the mine. He said that because the miners are not registered, taxing them becomes difficult as well as monitoring their activities. He said he knows that the mine had become “more commercial” and large-scale about four years ago.

6. DISCUSSION

Now nearly 100 hectares in size, as estimated by the GPS survey, the degraded sand mine site is large enough to have a considerable impact on land usage in the surrounding villages. It was noted from the interviews that farmers work with two hectares of land on average, and therefore 97 hectares of land could be enough for 47 farmers. This confirms the estimation and conclusion made by the Ghana Statistical Service (2010) that by far the majority of the population within the Tolon District are peasant farmers. This gives meaning to the declaration by some interviewed farmers who depend solely on farming, that the mine has rendered them jobless. Notably, it also confirms the World Resources Institute studies (2005) of human dependency on ecosystems for survival, which established that joblessness within rural areas is high because job opportunities are limited in these areas, leaving the population no other option than to depend more on natural resources available to them.

From the farmers’ point of view, they were concerned with reduction in access to variety in their diet, only referring to it as boring meals without meat, legumes or even fish, in most cases. However, this implies that the nutritional value of their diet can have deteriorated since the main component had become grains that are less expensive, without enough vegetables and legumes which had been harvested from their own farms at no purchasing cost before the farmlands were converted into a mine site. Consequently, the deterioration of the nutritional value of the diet of local people can affect their health as well.

These problems are even compounded by other health-threatening issues raised by the farmers, for instance a rise in malaria incidences amongst the villagers, most especially their children, due to frequent mosquito bites, the reason being the flood pools at the mine site serving as breeding grounds for mosquitoes. In addition, the abundance of flies from the waste deposited into some large pits at the mine makes the villages susceptible to cholera, because the bacteria *Vibrio cholera* is transmitted by house flies and when infested flies settle on food it could become contaminated. A study by Osei and Duker (2008) in the city of Kumasi in Ghana proved that areas close to open refuse dumps experiences cholera outbreaks more often than communities further away. This is not different from the situation described in this study. Hence the district may be heading towards future outbreaks of cholera, which is common in the country, if safer ways are not considered for the waste dumping within that area.

The members of the communities surrounding the mine have to endure all the aforementioned effects associated with the mining activity with almost no benefits apportioned to them. Sand and gravel are resources that are exploited from this area to satisfy the construction needs in the city of Tamale and beyond at the expense of the villagers’ source of livelihood, as well as other

negative impacts. This is a finding that is in line with the assertion made by Naab et al. (2013), that as a city expands, peripheral villages near it experience part of the pressures from the city through exploitation of the villages' natural resources to satisfy the needs of the city. Migration of some farmers affected by the mining activity to seek greener pastures in neighboring villages for farming or to take up trading in Tamale can be considered as the encouragement of rural urban migration among the working population of this area.

Apart from the impact of mining on humans, the earth surface is experiencing the greater part of the damage, just as presented by Lambin et al. (1999), who stated that land use that alters the vegetative cover, and even the structure, leaves an impact on the land. In this case, the images obtained of gullies, open pits and hard pan formation indicate that the impact of the sand and gravel mine on the land had been devastating. In this regard, the state of the land falls short of the criteria given by Millennium Ecosystem Assessment (2005) for healthy land. The site rather possesses features of what their study defines as degraded land. All the responses obtained from the environmental officers indicate that they were aware of the state of the land as "degraded", a word both environmental officers used to describe the condition of the land. This is no different from the meaning derived from local people's description of the land. Hence there is some awareness about land conditions by the people despite the fact that they expressed their helplessness in attempting reclamation.

If no alternative source of income generation is put in place to make up for the loss of fruit- and nut-bearing trees at the site, women will have to live without the money previously obtained from these trees. Nevertheless, since the occupation of the women mostly revolves around processing of the fruits and nuts of the trees, they are likely to be severely impacted for lack of skills in other occupational fields. In this situation, married women claimed they have no farmlands apportioned to them since their husbands are experiencing reduction in farm land size. This is in relation to an assertion by Awumbila (2006) that, if productive farmland becomes scarce within a village, that gives men greater portions of any inheritance, and women get a lesser portion of land, competed for by the men. In effect, the dependency rate of women is going to increase and, consequently, they might even become poorer unless they can get access to capital for alternative business sources, such as trading.

Although the chiefs claimed ownership of the land within the boundaries of their communities, it was also mentioned by all three chiefs that the Sagnarigu *Naa*, who is the paramount chief of the area, had awarded the contract to the entrepreneurs working at the mine site. This implies that traditionally the chiefs that are loyal to that paramount king can be faced with externalities with regard to decision making on their land. If none of the contractors or laborers involved in the mining activity dwells in any of the villages except for Tamale, then it could be deduced that the stakeholders in the communities that surround the mine site barely have a say in the operations. Nevertheless, the villagers suffer the mine impacts directly and are likely to continue to do so since sand mining in the area is continuing. The mine keeps on expanding.

Since the Environmental Officer from the EPA consulted for this study referred to the land ownership and land rights in the Northern Region as a whole as a "delicate issue" which even interferes with the discharge of the duties of EPA staff in issuing environmental permits for land use and subsequent monitoring, the situation could be complicated. According to Ayee (2007), there is no clear-cut definition of the duties and limits of chiefs in local governance. This assertion made by Ayee (2007), can be related to the pronouncement made by the environmental officer, whose agency is supposed to oversee environmental sustainability of the region. This becomes even more obvious, since the environmental officer at the DA shares the

same sentiment on the issue of traditional rule and formal legal regulatory bodies. Interference between sustainable land use with the traditional hierarchy which seems so difficult to pierce, gives the area no bright reclamation future, if the systems remain unchanged, or more specifically as sand and gravel miners want to remain in business. Areas mined will obviously expand and if the people are unable or unwilling to interfere in their activities with the fear of disrespecting the traditional authority's commands, which they treat as sacred, no change is possible. Subsequently, agriculture in the area will have to give way to sand and gravel mining, conditions surrounding the activity are flexible enough and remain in favor of the contractors involved. Indeed, this discovery proves that the customary land tenure system is supple and negotiable, as concluded by Berry (2001), albeit with sometimes highly negative consequences for members of these communities. In view of these flexible traditional arrangements, waste management companies that make use of the pits thus created and left behind for deposition of waste can continue to cause even further degradation.

7. CONCLUSION AND RECOMMENDATIONS

In brief, the findings of this research make it all too clear that the environment at the sand and gravel mine site at Golinga is severely degraded. The loss of topsoil from the land does not only affect ecosystems, but also affects the income generation sources of the people, their health and harmony in general. No reclamation plans are in place to enhance the reclamation of the mine site or recovery traditional land use, neither the abandoned and already mined parts nor the areas where mining is ongoing or yet to be mined. Villagers living with the detrimental consequences of the mine do not have enough awareness about the agencies to complain to formally to seek redress. There is no existing mutual action taken for the benefit of all the people who have been affected by the mining activity. The women of these areas, and therefore their children, are more disadvantaged than the men because of the limited farmland in their villages.

With issues surrounding the mine, people that need to be considered are the chiefs (including the paramount chief), community members, contractors and all employees of the mining activity, buyers of the sand and gravel, the Tolon District Assembly and Environmental Protection Agency of Tamale. The study did not include interviews with contractors or employees of the mine, nor the paramount chief, the Sagnarigu *Naa*. The people do not consider sand and gravel as illegal, although faced with the consequences of mining it. The traditional ownership and authority over the land use system practice in the Northern Region and in the Tolon District in particular, is contrary to the administration of the modern authorities. Therefore, the EPA and the DA find the challenges in interfering with land use and carrying out law enforcement as these institutions should be doing according to their mandate, insurmountable, to the detriment of the environment and the people.

The following recommendations are made for future consideration:

- The Environmental Protection Agency of Ghana should pay more attention to sand and gravel mining and its illegalities as well as its consequences for the general public.
- The Tolon District Assembly should include an officer from the Environmental Protection Agency on its statutory board, as stated in the District Assembly Act of 1992.
- Sand and gravel mining contractors should be registered and monitored, with reclamation plans as a requirement before a permit of operation is issued.

- Compensation to farm owners should be paid directly to them without intermediaries.
- The previous users should be empowered to demand the reclamation of the land.

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APPENDICES

APPENDIX 1. The GPS coordinates from the study area. The coordinates in the table represent all the points measured as part of the mine site.

ID	Latitude (N)	Longitude (W)	Elevation (m)	ID	Latitude (N)	Longitude (W)	Elevation (m)
251	9.39271	0.94571	147	296	9.37862	0.94537	156
252	9.39114	0.94518	145	297	9.37762	0.94492	155
253	9.39027	0.9481	147	298	9.37898	0.94461	156
254	9.38984	0.94573	147	299	9.379	0.9446	155
256	9.38923	0.94501	151	300	9.37992	0.94512	157
257	9.38901	0.9449	158	301	9.38072	0.94502	157
258	9.38874	0.94453	160	302	9.3839	0.94559	157
259	9.38826	0.94373	157	303	9.38083	0.94652	158
260	9.38767	0.94346	157	304	9.38152	0.94666	156
261	9.38728	0.94365	159	305	9.38219	0.94651	159
262	9.38657	0.94325	159	306	9.38292	0.94716	158
263	9.38573	0.94257	155	307	9.38346	0.94677	159
264	9.38547	0.94219	154	308	9.38511	0.94764	159
265	9.38511	0.94161	154	309	9.38722	0.94806	161
266	9.38444	0.94166	153	310	9.38721	0.94862	160
267	9.38408	0.94089	153	311	9.38655	0.94851	159
268	9.38365	0.94037	151	312	9.38631	0.94781	161
269	9.38248	0.94083	151	313	9.38801	0.94897	161
270	9.38191	0.94094	151	314	9.38864	0.94833	163
271	9.3821	0.94132	153	315	9.38875	0.94931	161
272	9.38343	0.94154	152	316	9.38921	0.94923	161
273	9.3835	0.94214	154	317	9.38965	0.94869	162
274	9.38297	0.94226	154	318	9.39056	0.94977	165
275	9.38317	0.94243	154	319	9.39108	0.94947	163
276	9.38267	0.94274	154	320	9.39135	0.9498	166
277	9.38302	0.94325	155	321	9.39493	0.94853	165
278	9.38311	0.94359	155	322	9.39485	0.94822	169
279	9.383169	0.944	156	323	9.39662	0.94787	172
280	9.38154	0.9433	154	324	9.39891	0.94698	176
281	9.38031	0.94376	153	325	9.39888	0.94651	177
282	9.37977	0.94377	153	326	9.3989	0.94625	175
283	9.37925	0.94364	154	327	9.39917	0.94622	177
284	9.37936	0.94276	154	328	9.39906	0.94562	174
285	9.37939	0.94316	152	329	9.39813	0.94556	172
286	9.38902	0.94151	151	330	9.39694	0.94605	172
287	9.37888	0.94229	151	331	9.39659	0.94607	173
288	9.37835	0.94262	153	332	9.39059	0.94928	165
289	9.37815	0.94202	152	333	9.39482	0.94515	168
290	9.37713	0.94228	153	334	9.39456	0.94479	167

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291	9.37689	0.94403	154	335	9.39391	0.94491	167
292	9.37784	0.94476	155	336	9.39388	0.94534	168
293	9.3783	0.94483	155	337	9.39349	0.94535	167
294	9.37779	0.9452	156	338	9.39343	0.94586	169
295	9.37825	0.94556	157				

APPENDIX 2: Sample of interview questions for community members.

INTERVIEW QUESTIONS FOR COMMUNITY MEMBERS

the Degraded Sand Mining Site at Golinga, Northern Ghana

By: VIDA ARTHUR, UNU- LRT, 2016

I seek your concern to ask you some few questions that will take about an hour of your time. This is a study on the Sand Mining Site:

1. Please, do you own a piece of land in this community for farming? (No. of acres, if yes)
2. What process must you go through before you have access to use land here?
3. How can a non - community member obtained access to use or own a portion of land in this village?
4. When did the sand mining activities in this area start?
5. What was the land previously used for?
6. Do you know why the area was chosen for sand mining?
7. Who are those involved in the sand mining activities; community members or outsiders?
8. Were any agreements sought from the community before this activity?
9. Is the community entitled to any benefit from the sand mining? Yes/ No
10. What type of benefits? Please specify, if any.
11. Have you personally benefited from the activities? Yes / No
Please specify, if yes;
12. How would you describe the effect of the present state of that portion of land on your income level?
13. Has the sand mining affected? Please tick appropriately.
a. Farming activities b. health c. convenience
14. Has it affected the allocation size of farm lands for women? Yes/No
How, if yes?
15. In what ways are women catered for in the absence of the perennial fruit trees on the land?
16. Do you recognized any other problems associated with the mine site?
Yes/ No
17. If yes, what are they?
18. Which do you personally think is better; the previous land use or the present activity on the land? a. Previous b. Present

DEMOGRAPHIC CHARACTERISTICS

1. Sex (a) Male (b) Female
2. Age (a) Below 30yrs (b) 30-45yrs (c) 45yrs and above
3. Occupation
(a) Civil servant (b) Artisan (c) Trader (d) Farmer
4. Educational background
(a). Tertiary (b) Secondary (c) Basic (d) No formal education

APPENDIX 3: Sample of interview questions for community Chiefs

INTERVIEW QUESTIONS FOR COMMUNITY CHIEFS

The Degraded Sand Mining Site at Golinga, Northern Ghana

By: VIDA ARTHUR, UNU- LRT, 2016

I seek your concern to ask you some few questions that will take about an hour of your time.

This is a study on the Sand Mining Site:

1. How does an individual in your community get the right and access to use land in your community?
2. Are you the overseer of all the land belonging to this community?
3. How can a non - community member obtain access to use or own a portion of land in this village?
4. Who are those involved in the sand mining activities; community members or outsiders?
5. Did they obtain the required permit from your authority?
6. When did the sand mining activities in this area start?
7. What was the land previously used for?
8. Why was that area chosen for sand mining?
9. Were any agreements sought from the community members before this activity?
10. What about agreement from the EPA / DA?
11. Is the community entitled to any benefit from the sand mining? Yes/ No
12. If yes, please specify the type of benefit.
13. Have you personally benefited from the activities as the chief? Yes / No
14. Specify the type of benefit obtained (if answer to question 13 is yes).;
15. Was any responsibility given to the sand mining operators to restore the land back to its former state?
16. What has been the obstacle for them to carry this out?
17. How would you describe the effect of the present state of that portion of land on your income level?
18. Has the sand mining affected? Please tick appropriately: a. Farming activities b. health c. alternative livelihood sources?

19. Has it affected the allocation size of farm lands for women? Yes/No
20. In what ways has it been affected? (if answer to question 19 is Yes)
21. In what ways are women catered for in the absence of the perennial fruit trees on the land?
22. Do you recognize any other problems associated with the mining activities? Yes/No
23. What are the problems, if there are any?
24. Which do you personally think is better; the previous land use or the present activity on the land? a. Previous b. Present
25. What type of plant species were in existence before its clearance?

DEMOGRAPHIC CHARACTERISTICS

5. Sex (a) Male (b) Female
6. Please, for how long have you been a chief in this community?.....yrs
7. Age (a) Below 30yrs (b) 30-45yrs (c) 45yrs and above
8. Occupation apart from chieftaincy? (a). Civil servant (b) Artisan (c) Trader (d) Farmer
9. Educational background
(a). Tertiary (b) Secondary (c) Basic (d) No formal education

APPENDIX 4. Sample of interview questions for an environmental officer at the Environmental Protection Agency, Tamale office.

**INTERVIEW QUESTIONS FOR ENVIRONMENTAL OFFICER
ENVIRONMENTAL PROTECTION AGENCY- TAMALE**

The Degraded Sand Mining Site at Golinga, Northern Ghana

By: VIDA ARTHUR, UNU- LRT, 2016

I seek your concern to ask you some few questions that will take about an hour of your time. This is a study on the Sand Winning Site at Golinga:

POSITION OF PERSON INTERVIEWED:

SEX:

1. For how long have you been in charge as the environmental officer for the district?
2. Is your office responsible for issuing permits for commercial use of land in the Tolon district?
3. Has the sand winning activity in Golinga been brought to your notice?
4. When did the sand winning activities in the area start?
5. Did the operators obtain the required permit from your authority?
6. CHECK ?
7. Were the operators required to restore the land after it had been mined?
8. What has been the challenge in ensuring that the Sand Winning operators comply with rehabilitation requirements?
9. Is there an existing law backing land restoration after use?
10. What would you say about the land use changes that have occurred in that area?

APPENDIX 5. Sample of interview questions for an environmental officer at the Tolon District Assembly's office.

**INTERVIEW QUESTIONS FOR TOLON DISTRICT ASSEMBLY-
ENVIRONMENTAL DEPARTMENT**

The Degraded Sand Mining Site at Golinga, Northern Ghana

By: VIDA ARTHUR, UNU- LRT, 2016

I seek your concern to ask you some few questions that will take about an hour of your time. This is a study on the Sand Winning Site:

1. For how long have you been in charge as the environmental officer for the district?
2. Is your office responsible for issuing land rights in the Tolon district?
3. Has the sand mining activity in Golinga been brought to your notice?
4. When did the sand mining activities in the area start?
5. Did the operators obtain the required permit from your authority?
6. Were the operators required to restore the land?
7. Is there an existing law backing land rehabilitation after use?
8. What has been the challenge in ensuring that contractors like the sand mining operators comply with the restoration procedures?
9. What would you say about the land use changes that have occurred in that area?