

Searching and Cracking: Stone Quarrying, Livelihood and the Environment in the Daglama Quarry Site in the Ho Municipality

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Abstract

Adequate and secure livelihoods have become a major concern for both rural and urban dwellers. In these areas, economic hardship and poor agricultural yield, following the adverse effects of climate change have compelled many people to search for alternative livelihood strategies. In the Ho Municipality, stone quarrying has become one of the alternative livelihood strategies. Stone quarrying is a form of land use method concerned with the extraction of non-fuel and non-metal minerals from rocks. Using the qualitative model, the paper interrogates the impact of stone quarrying on the livelihoods of the workers and provides critical insights into the effects of stone quarrying on the environment. It finds economic hardship, unemployment, rural-urban migration as some reasons the inhabitants engage in stone quarrying in Daglama. It further finds stone quarrying as a source of livelihood in Daglama. However, the practice has negatively affected the environment. It has led to the destruction of arable land, forest reserves and others. The paper also highlights the negative health implications stone quarrying has on the workers in the industry.

Introduction

Agriculture and mineral extraction play a critical role in improvement of rural livelihoods and also helps to alleviate rural poverty. Even though agriculture remains the key strategy for rural poverty reduction, access to agricultural land remains a major challenge to the majority of the rural poor. It is estimated that about 45 per cent of the world's population do not have access to land (Fellmann et al, 2005). This has compelled over 500 million people in developing countries to engage in occupations such as small-scale surface mining and quarrying for survival (Wang et al, 2010).

In Africa, East Asia, Southeast Asia and Latin America, accessibility to natural resources plays a critical role in the livelihood conditions of people. This is so because the formal sectors in developing countries have very little potential in terms of job creation (Ibrahim, 2007), thus the informal sector has become an alternative for achieving livelihood needs. However, population growth and its concomitant high demand for natural resources have put severe stress on the available resources with dire consequences on their sustainability. Over

exploitation of the natural environment has depleted most resources and rendered most productive land beyond repairs (IEG, 2008). This development is likely to compound the health and unemployment problems of the poor majority seeking alternative means of livelihoods in rural areas.

The World Bank (2001) indicates that over 40 per cent of the world's population are poor and approximately 75 per cent of rural residents in developing countries experience absolute poverty. These people are regarded as landless, powerless, marginalized, vulnerable and disadvantaged. Since the poor rural dwellers have limited access to the socio-economic benefits that are easily accessed by urban dwellers, they usually seek livelihood opportunities in the primary and informal sectors of the economy especially in subsistence agriculture, small-scale mining and quarrying (Birabwa, 2006).

In Malaysia, it is estimated that the informal sector employs the services of over 70 per cent of the population, with the quarry industry employing 30 per cent (Ibrahim, 2007). Brajesh (2006) points out that in India,

rural households depend largely on non-farm activities in order to make a living. Fellmann et al (2005) also indicate that about 20 per cent of residents occupying the Ukrainian massif also depend largely on quarrying for income and to cater for the needs of the family.

Asante et al (2014) argue that the situation is not different in Africa. They argue that many people in rural Africa see non-farm activities as pre-occupation as it has been noted that dependence on agricultural output no longer provide year-round security in terms of finance due to decline in farm yields. This has been confirmed by Birabwa (2006) and Wells (2000) in Uganda and Kenya respectively. According to the Ghana Statistical Service (2008), about 80 per cent of the economically active population in Ghana work in the informal sector. In most rural and peri-urban Ghana, people engage in non-farm activities to supplement family income. Indeed, the situation is not different in the Ho Municipality as some rural and urban dwellers have resorted to stone quarrying as an alternative source of livelihood for survival. This paper therefore interrogates stone quarrying and its impact on the environment in the Daglamma community.

Stone Quarrying and the Environment: a review of relevant literature

A quarry is a type of open-pit mine from which rock or minerals are extracted (Gamal El-Dine et al, 2009). Coppin (1982) also states that quarrying is an open cast excavation from which fairly massive and deep deposits of hard or soft rocks are extracted. Quarries are normally utilized for extracting building materials like dimension stone and are normally shallower than other kinds of open-pit mines. Quarries are made when big deposits of commercially helpful minerals or

rocks are found close to the earth's surface. Stripping is the initial step in the quarrying operation and involves removal of topsoil and sub soil that covers mineable material and a variety of equipment is used to strip, transport and redeposit sub-soil (Bauer, 1991). Stone quarrying is a form of land use concerned with the extraction of non-fuel and non-metal minerals from rocks (Ukpong, 2012). It is usually done by open-cast method using rock drills, explosion of dynamite and use of other methods (Lad & Samant, 2014).

There is a wide range of potential effects caused by quarries and inevitably affects the sustainability of the environment. Kitula (2004) argues that stone quarrying has environmental and health effects; it has adverse impacts on the natural environment, society and cultural heritage, and the health and safety of the workers. Sati (2015) maintains that stone quarrying, whether small or large scale, are inherently disruptive to the environment, producing enormous quantities of waste that can have noxious impacts for decades, and that the environmental deterioration caused by stone quarrying occurs mainly as a result of inappropriate and wasteful working practices and rehabilitation measures. The level of land degradation caused by stone quarrying in Ghana has put forth questions as to whether or not the activity should be allowed to continue (Nartey et al, 2012). In addition, some 4 million people have been reported to die yearly from acute respiratory problems in developing countries, the most part being aggravated by environmental pollution emanating from quarrying, sandblasting and emission of dangerous chemicals (Langer, 2001; Asante et al, 2014; and Carney, 1998). Abate (2016) also identifies fatal accidents, physical injuries, respiratory diseases such

as silicosis and tuberculosis as some health problems confronting workers in the quarry industry.

Gale and Groat (2001) point out that some environmental disturbance created by quarrying is caused directly by engineering activities during aggregate extraction and processes. They aver that the obvious engineering impact of quarrying is a change in geomorphology and conversion of land use, with its associated visual change. This major impact, they noted, could be accompanied by loss of habitat, noise, vibrations, chemical spills, erosion, sedimentation and dereliction of the mined site. Similarly, Sreenivasa and Reddy (2014) hold the view that the major impacts of quarries to the environment are water pollution, land degradation, noise pollution, vibrations and landslides. To them, this could directly or indirectly affect human life and the environment. A report by the World Bank working group on environmental sustainability reveals that occupations such as lumbering, mining, quarrying, and sandblasting degrade the environment and worsen the plight of the poor (IEG, 2008).

Maponga and Munyanduri (1998) also argued that quarrying negatively affects the environment in a variety of ways during exploration and blasting, transportation and disposal of waste rocks. They assert that major environmental effects are destruction of vegetation, disruption of animal habitats, diversion and blockade of natural drainage systems, soil erosion and river siltation, noise and vibration, and dust pollution. They further note that quarries may also damage or destroy sites of scientific, archaeological, and cultural interest and can negatively affect the local tourism industry. Chizoro et al (1997) emphasize that quarrying has land

use policy implications; it is either agriculture vs. quarrying or a coexistence of agriculture, often a source of conflict over traditional uses of land. He also added that the clearing of land to develop access roads and to open up mining sites destroys habitats for wild animals, reduces grazing and reduces sources of plant life for human beings and animals. Besides affecting the locals, Munyanduri (1998) argued that quarrying affects ecological balance by disrupting the food chain. Finally, Stehouwer et al (2006) posited that quarrying activities exert tremendous pressure on limited soil and water resources, thus increasing the rate of erosion processes and subsequent damage of existing arable lands.

In spite of the negative effects of stone quarrying on the environment and health, this activity generates employment and contributes to the sustenance of livelihoods. Lahiri-Dutt (2006) also opines that stone quarrying generates considerable employment opportunities as it is relatively labour intensive and under-mechanized industry. Asante et al (2014) maintained that stone quarrying provides varying economic benefits to the local economy. They added that in Buoho in the Ashanti Region, majority of the local people depend on stone quarrying as a source of livelihood. Sustainable livelihood can also be understood in the context of the Three (3) Es (Environment, Equity and Economics). The environmental component of sustainable livelihood refers to the conservation of natural resources and the reduction of negative impacts on eco-systems. It is also concerned with the protection of natural habitats, conservation of resources, ensuring air and water quality, reducing pollutants as well as reducing waste. On the other hand, Equity represents the belief that there are some

things which people should have, that there are basic needs that should be fulfilled, that burdens and rewards should not be spread too divergently across the community, and that policy should be directed with impartiality, fairness and justice towards these ends. It also maintains that there should be a minimum level of income and environmental quality below which nobody falls. In the society therefore, everyone should have equal access to community resources and opportunities, and that no individuals or groups of people should be asked to carry a greater environmental burden than the rest of the community as a result of government actions. (Beder, 2000:2). The last “E” – Economics – is an important pillar of sustainable development. It argues that the natural environment is an important component of economic system, and without the natural environment, the economic system would not be able to function. It also states that with better management of natural resources, we could obtain a larger supply and wide range of goods and services (Beder, 2000:3). Indeed the Three E’s concepts fit well into the stone quarrying activities in Daglama. The first being that the local people use land as a viable economic resource in sustaining their livelihood. However, in exploiting the land for their economic survival, the methods and approaches adopted are unfriendly to the environment and the ecosystem. Hence, it poses a lot of threat to environmental sustainability as plant and animal life is being threatened by stone quarry activities. In spite of this, the main cause of this problem is rooted in social inequality and inequity as a result of lack of opportunities for many people. This situation has brought about the unfriendly and unconservative use of the Daglama land.

The literature also outlines the negative

effects of stone quarrying on the environment and ecosystem as well as the health of the workers. However, the literature makes it clear that stone quarrying is a livelihood strategy for many people in the rural and peri-urban communities. It is obvious that no such work has been done in the Ho municipality which is a gap that this research fills. The significance of this study is to ascertain the various impacts that stone quarrying has on the workers in Daglama as well as how their operations affect environmental sustainability. This will add to the wide range of literature on stone quarrying and its environmental effects in Ghana and Africa.

Theoretical Framework: Sustainable Livelihoods Framework and Quarrying

The Sustainable Livelihood Approach (SLA) was developed by the Department for International Development (DFID). This approach centers on both people and their livelihood; prioritizing both the tangible and intangible assets utilized to achieve their desires. The approach also considers the vulnerable environment the poor operate in and their ability to withstand shocks and stresses, amidst external forces such as policies that affect accessibility of the assets upon which people depend. A livelihood according to Chambers and Conway (1992) comprises capabilities, assets and activities required for a means of living. It is considered sustainable when it can cope with and recover from stress and shock, maintain and enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation and contributes net benefits to other livelihoods at the local and global levels in the long and short term. Helmore and Singh (2001) identify sustainable livelihood

as one that maintains ecological integrity of the environment.

This approach is founded on the belief that people require a range of assets to achieve positive livelihood outcomes. No single category of assets on its own is sufficient to yield varied livelihood outcomes that people seek but are utilized synergistically to pursue the different livelihood people aspire. The relevance of the Sustainable Livelihood Approach lies in the fact that it is people centered. It seeks to gain an accurate and realistic understanding of people's strengths and how they endeavour to convert these into positive livelihood outcomes. The approach does not perceive the poor to be in 'lack of' but it recognizes the inherent potential in individual's households and communities, which is used to build positive livelihood outcomes (Helmore and Singh, 2001).

This approach is relevant to stone quarrying in understanding how individuals meet their needs using minimal financial input, simple technology, and indigenous resources amidst competitive formal market and restrictive government policy. Indeed, stone workers employ different assets available to them to achieve different livelihood outcomes. In an effort to ensure development, laws and policies are often in place to limit the over exploitation of these resources. In most cases however, these have not worked satisfactorily. The Sustainable Livelihood Framework (SLF) constitutes the path of the Sustainable Livelihoods Approach and serves as an instrument for the investigation of poor people's livelihoods. The framework is divided into five key components, which include the Vulnerability Context, Livelihood Assets, Transforming Structures and Processes (policy, institutions, and processes), Livelihood

Strategies and Livelihood Outcomes. The vulnerability context in the framework is viewed as an external environment in which people exist (DFID, 1999). In relation to quarrying, the Vulnerability context encompasses shocks such as accidents, diseases, and death occasioned by the activity. It also includes price fluctuations, loss of stone products and loss of money during business transactions. Seasonality and trends in the framework can also be related to stress, which are predictable events that affect livelihood outcomes attained from a livelihood strategy. Seasonality in relation to stone quarrying can be related to the weather changes that affect productivity at the quarry especially during rainy season. Seasonality can also be related to the price fluctuations that are mainly determined by the demand for stone products. All these may have a temporary or permanent effect on the income flow of an average or poor income household.

The vulnerability context also acknowledges how people cope with stress and shock associated with their livelihood activity. As coping strategies, the stone workers would diversify their livelihood portfolios or lean on other family members to survive. Common in informal activities such as stone quarrying is the reliance on social networks such as family, friends for material and immaterial support. Assets according to the framework are presented in the asset pentagon, which shows the different assets people use to realize their livelihood outcomes. Ellis (2000) defines assets as natural capital (such as land, water, forests), human capital (including skills, knowledge, physical capability and ability of labour), physical capital (infrastructure such as roads), and social capital (safety networks, social claims, social relations). Thus, within

a certain context, the use of these assets and appropriate strategies would yield livelihood outcomes. This framework largely guides the organization of this current research in Daglama.

Materials and Methods

This study adopted the qualitative approach and the study was predominantly based on primary data collected from the field. Data for the study was obtained through in-depth interviews with workers in the Daglama quarry site. The aim of conducting in-depth interviews was to explore into details the views of the respondents about stone quarrying and its effects on the environment. The analytical point of departure from previous studies is the availability of data obtained from oral narratives, unlike previous studies, which explore extensively the quantitative method. Simple random and purposive sampling techniques were adopted to select 50 informants between the ages of (20) and

sixty (60). This comprises 22 males and 28 females working at the quarry. The reason for this distribution was that, women were more than the men at the quarry site. The purpose of the study was explained to the respondents and their consents sought before collecting the data. Data was collected from August 2016 to June 2017. The interviews were conducted in Ewe, translated, transcribed and analyzed thematically.

Study Area

This study was conducted at Daglama, a stone quarry site in the Ho Municipality of the Volta Region. The meaning of Daglama is “The abode of dangerous snakes”. Daglama is an area in Sokode Lokoe where quarry activities take place. Due to the forested nature of the place coupled with the numerous dangerous snakes and other animals, the place is uninhabited. This area has a vast vegetation zone and fertile lands for agriculture productivity. The area also encourages animal husbandry where

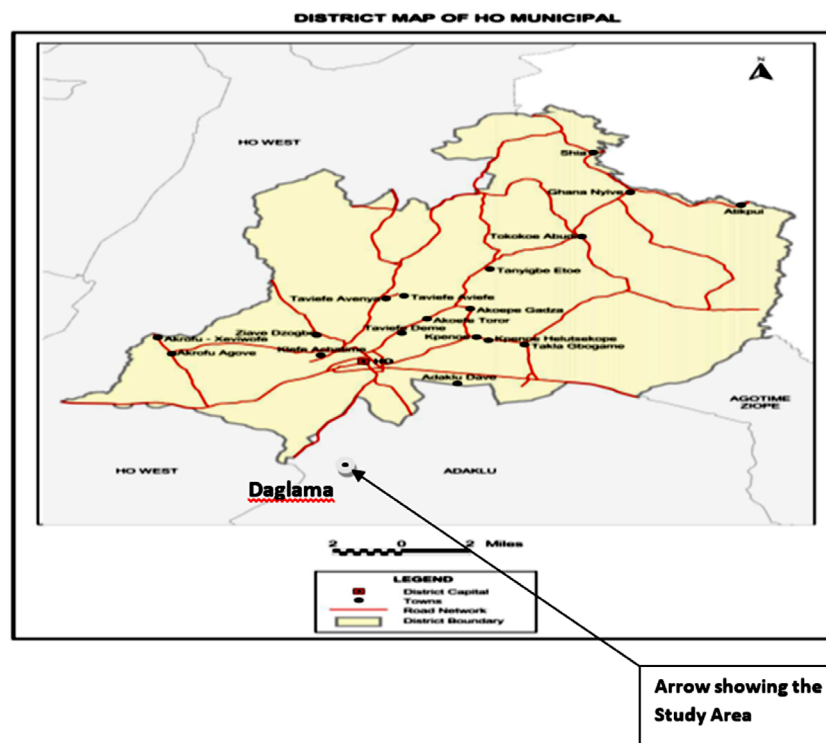


Figure 1: District map of Ho Municipality (Source: Ghana Statistical Service, 2010)

the Fulani herdsmen on daily basis graze their cattle. This area is currently the permanent campus of the University of Health and Allied Sciences (UHAS). The area is rich in stones, which attract people from Sokode Lokoe, Ho, Ando and Adaklu Kodzobi to carry out stone quarrying. About 20 tipper trucks load stones from the site to construction sites in and around Ho each day.

However, following the establishment of UHAS, people are beginning to focus their attention on the development of their private plots within the area. The area is gradually being opened up due to the presence of the university. Internal road constructions are underway within the university community while the dual carriage road linking Sokode Etoe to Ho Regional Airport is also under construction. These constructional works have also intensified the quarry work in the area as there is easy access to the quarry site, either through Adaklu Kodzobi or Voradep Village, a suburb of Ho. Below is a map of the Ho Municipality, showing Daglama, the area of

study.

The Socio-Demographic Background of Interviewees

The socio-demographic background of workers in Daglama as captured in this study focused on sex, age and the education levels of the respondents. This was to enable the researchers identify the characteristics of the respondents and their involvement in quarry activities as their source of livelihood. According to Togunde (2006) and Osiruemu (2007) formal education is an important tool for human capacity development. Accordingly, people with low or no education tend to engage in informal economic activities such as quarrying. This observation made by these scholars is consistent with the findings on the field. It was observed that majority of the respondents had no formal education while others were drop-outs. Below is the graphical presentation of the data.

From Table 1 above, there were twenty-two (22) male and twenty-eight (28) female

TABLE 1
Data showing the socio-demographic features of respondents

Sex	Male	Female	Total
Frequency	22	28	50
Percent	44	56	100
Age	Male	Female	Total
20 – 29	6	5	11
30 – 39	12	14	26
40 – 49	3	6	9
50 – 59	1	3	4
60 and above		-	-
Grand Total	22	28	50
Percentage	44.0	56.0	100.0
Education	Male	Female	Total
Primary	2	8	10
JHS	5	6	11
Secondary	1	2	3
Never been to school	14	12	26
Grand Total	22	28	50
Percentage (%)	44.0	56.0	100.0

respondents. This distribution stems from the fact that in the quarry site, women were more than men. Women who work at the quarry site constitute 56% of the population while the men constitute 44%. In terms of age, the average age is 30 and this constitutes 52% of the population. Generally, the youth are the dominant group of people involved in stone quarrying in Daglama. In terms of education, 26 workers, constituting 52% of the population never had any form of education. In addition, 24 workers, constituting 48% have had some form of basic education. However, interactions with the respondents show that most of them did not complete their basic education. For this reason, they are unskilled workers. As noted earlier, workers in Daglama are from Sokode Lokoe, Ho, Ando and Adaklu Kodzobi towns, the latter of which is located in the Adaklu District of the Volta Region.

Reasons why People engage in Stone Quarrying in Daglama

It is important to examine the urban and peri-urban nature of Ho and its environs in order to understand the reasons why stone quarry emerged in Daglama. In spite of the fact that Ho is the regional capital of the Volta Region, it is characterized by high unemployment rates. This constitutes one reason why people engage in stone quarrying in Daglama. Many unemployed junior high school graduates have not been able to continue with their education to the senior high school level. There are also many senior high school graduates who are unemployed for other reasons. In addition, there are people who have not been to school before and are unemployed, the result of which is their engagement in stone quarrying to sustain their livelihood.

Rural-urban migration is another reason

for the development of a stone quarry in Daglama. The urban nature of Ho has attracted many youths from the periphery. Similarly, the youth from the Republic of Togo often migrate to Ho in search of unavailable jobs, thereby intensifying the already existing problem of unemployment. It was found that the political turmoil in Togo is a catalyst to the high rate of migrants from Togo into Ho who also engage in stone cracking to make a livelihood. In the light of the above problem, several people facing worsening economic and political situations make use of exploitable natural resources (agricultural lands, forests, streams etc) found within the municipality. This situation culminated in the emergence of stone quarrying in Daglama.

Originally, stone quarrying took place in the Hofedo Electoral Area in an area called Kpedome. However, following an increase in the population of the area, land-owners developed their plots by putting up structures. This situation forced workers to look for alternative place for their livelihood, leading to the emergence of quarry work at Daglama. It is interesting to note that in spite of the several hazards involved in quarrying, it is not uncommon to find numerous adults and children working at the quarry. This is due to the fact that the quarry provides regular and sustainable sources of income compared to other informal economic activities in the town. Several visits to the quarry site and interviews with quarry workers revealed that lack of compensation to landowners of Sokode Lokoe partly culminated into quarry activities in Daglama. The respondents noted that the land on which they work belonged to individual families in Sokode Lokoe which the government took from them for the establishment of the University of Health

and Allied Sciences. But the respondents argued that because the government is yet to compensate the landowners, the workers have capitalized on that to quarry the land. Some family members of the landowners were actually involved in quarrying themselves. Below is an extract from the field:

“This land was taken from us by the government to establish this university. We were promised that we were going to be compensated. As I speak to you now, we are yet to be compensated. But we have to survive. Hence the need to engage in stone quarrying while we wait for the compensation.”

Equally important factor is economic hardship. Some respondents pointed out that economic hardship is a major factor for their engagement in stone quarrying. Some of these respondents are artisans, masons, petty traders, photographers, hairdressers and seamstresses. They pointed out that the decline in their businesses, with its consequent economic hardship compelled them to engage in stone quarrying. Below is an extract from an informant:

“I was forced to come to Daglama because my business had collapsed. I am a seamstress and I had a shop around the military barracks. But due to decline in patronage, I had to close my shop. Sometimes, when you sew

clothes for people, it could take four months before the person will come for it. Some people too will never come for it. This is also because customers do not also have available resources to pay for the cost of sewing. This situation brought about economic hardship. I heard about this place and I came to join the quarry business”.

Power, Responsibilities and settlement structure at the Quarry Site

From the field, it was observed that workers were not formally organized as a group, and there were no clear leaders in charge of ensuring members complied with some rules and regulations. In fact, there were no rules and regulations governing their operations. But one significant observation that was made was that, nobody interferes in another persons' area of operation. Everybody is independent and chooses a particular place to quarry. Quarry activity in Daglama was found to be a family business involving parents/guardians, children, grandparents and grandchildren. The study revealed that activities performed by children were similar to those performed by adult workers, even though some physically demanding activities were reserved for the adults. Child labour thus characterizes the Daglama quarry site.



Fig. 1a. Three dwelling sheds at the site
Photograph taken by the researchers, 27/10/2017



Fig. 1b. A dwelling shed in the site
 Photograph taken by the researchers, 27/10/2017

Children were involved in carrying stones in head pans/bowls and gathering them into a pile; they were also involved in breaking the stones into small chippings with hammers. They also ran other errands as the need be. The adults were engaged in digging of stones from opened shallow pits, organizing the stones into piles, cracking and breaking of stones as well as loading of tipper trucks. The migrants from Togo have constructed small sheds in the quarry site, which they use as temporary housing. They work in the quarry throughout the day and sleep under those sheds at night. Some of the sheds are located close to the open-pits where the stones are dug. Below is a picture of some of the sheds. In all, there are over two hundred and fifty (250) workers in the quarry site.

The Stone, our Life: Quarrying as a source of Livelihood

Livelihood is the command an individual, family or other social group has over an income or bundles of resources that can be used or exchanged to satisfy their needs. This may involve information, cultural knowledge, social networks, legal rights as well as tools, land or other physical resources (Blaikie et al, 1994; Valdivia et al, 1996). Indeed, stone quarrying in Daglama, according to

the respondents contributes to livelihood sustenance and survival.

First, stone quarrying provides direct and indirect employment to residents of Sokode Lokoe, Ando, Ho and Kodzobi. Direct employment relates to drivers and those involved in loading the stones at the quarry site. Indirectly, it includes self-employed individuals who operate as workers in the quarry site. There are also those who sell water, fruits and food in the quarry site. These food vendors are mobile, moving from one place to the other to sell. Taxi drivers also make their gains by conveying workers to and from their homes. There are other workers, mainly men, whose duty is to dig big stones and rocks using the flame burning method; after that, they sell it to the women to break. All these have thus provided indirect employment to these workers in the site.

Stone quarrying also contributes to household income and wellbeing. The respondents argue that stone quarrying provides regular income to the family since there is ready market for stone products. Data gathered from the field indicates that weekly, workers in the industry earn between Gh¢ 300.00 and Gh¢ 600.00. Below is an extract from the field:

“The stone business is good and is rewarding. This is because in every two weeks, I get

money. I earn not less than Gh¢ 300.00 every two weeks. This is because, our products are in high demand by road contractors and builders. Every day, the trucks come around to buy stones. Once you are able to obtain a heap of chippings, they will buy. This explains why we normally involve the entire family in cracking. Because of that, I always manage to get a trip every two weeks. This has contributed to my family upkeep”

The ready market for stone products in the quarry industry has seen the inflow of migrant workers, who want to make quick money. This finding is consistent with Kuntala Lahiri-Dutt (2006) who argues that stone quarrying contributes to considerable employment and income levels of families and individuals.

The Impacts of Stone Quarrying on the Environment and Land use in Daglama

Helmore and Singh (2001) identified sustainable livelihood as one that maintains the ecological integrity of the environment. From the field work, it is observed that the operations of quarrying regarding environmental sustainability in Daglama is put to serious question. As would be seen, Daglama land supported agriculture until the stone quarrying started in the site.

One major environmental impact of stone quarrying in Daglama is environmental degradation. Environmental degradation is the deterioration of the environment through the depletion of resources such as air, water and soil; it also includes the destruction of ecosystems, habitat destruction, and the



Fig. 2a. Women cracking stones at the site
Photograph taken by the researchers, 27/10/2017



Fig. 2b. Destruction of forests in Daglama
Photograph taken by the researchers, 27/10/2017

extinction of wildlife as well as pollution. In that area, the land is stripped of its vegetative cover, making it more vulnerable to agents of denudation. Consequently, other related problems such as soil erosion occur and wash away the top soil, creating gullies all over the site. Below is a picture of the quarry site showing how the operation contributes to environmental degradation.

Destruction of forest reserves is another impact of stone quarrying in Daglama. The operations of the quarry workers have led to the wanton destruction of the vast forest reserve. This situation has consequently contributed to the destruction of the ecosystem. According to the respondents, due to the operations of the quarry workers, animals such as antelopes, and deer and other dangerous snakes such as pythons have migrated to the Kalakpa Reserve, which

is located in the Adaklu and Ho West Districts. In addition, the cutting down of important trees, the destruction of the vegetative cover and the destruction of important plant species that have very high medicinal value have led to ecological imbalance in the quarry area. Below is a quote from an informant:

“In the past, this area had a lot of animals and plant species. Animals such as rabbits, antelopes, guinea fowls, and grass-cutters have migrated to the far distant area due to human activities and the destruction of the forest. Some important medicinal plants have also been destroyed due to quarrying activities in this area.”

Closely related to the above impact is the destruction of arable land. According to the respondents, Daglama lands are very fertile for agricultural productivity. Crops such as



Fig. 3a. A picture of a maize farm
Photograph taken by the researchers, 27/10/17



Fig. 3b. A picture of another maize farm
Photograph taken by the researchers, 27/10/17

maize, cassava, yam, pepper, okro, plantain and tomatoes grow well in this area. However, due to the quarry activities, the arable land has been destroyed. A vast land within the community can no longer support effective agricultural productivity. Farmlands that previously supported agriculture have been destroyed and others used as quarrying sites. Below is a picture of the arability of the Daglama area.

The pictures above illustrate two small maize farms cultivated by one of the quarry workers. These maize farms suggest how fertile the Daglama land was and how it has been destroyed through stone quarrying. A respondent alluded as follows:

“The Daglama land was a fertile land that

supported farming and animal husbandry. The land supported different kinds of crops such as cassava, yam, plantain, pawpaw, mangoes, palm trees, pepper among others. Currently, much of the arable land had been destroyed due to the quarry activities. If this situation continues, in the near future, the entire area cannot support agricultural productivity and animal husbandry”

Finally, air pollution is another environmental impact of stone quarrying in Daglama. This is basically caused by the flame burning method. The flame burning method is used by extractors who gather firewood around big igneous rock, set fire around it and burn to soften it. This process is also enhanced through the use of lorry tires. Once rocks are



Fig. 4a. Flame burning taking place
Photograph taken by the researchers, 27/10/17



Fig. 4b. The lead researcher with two respondents
Photograph taken by the researchers, 27/10/17

softened, a big hammer – referred to as the “more hammer” – is used to break down the rock into slabs before they are finally chipped. This flame burning process contributes to air pollution within the quarry site. It releases carbon monoxide into the environment.

The Health Impact of Stone quarrying on the Workers

Data collected from the field indicated that workers in the Daglama quarry site face many health challenges. During an interview session with some medical officers in the Hope Clinic which is located in Voradep Village, the closest clinic to the Daglama site, data collected indicated that there are numerous health challenges that confront workers in the site. The nurses pointed out that there has been an increase in dust related diseases among the workers in the site. Cases of cough and blood spitting, chest pains, bodily pains, waist pains, and pneumonia have been recorded as health challenges confronting workers in the Daglama quarry site. In addition, headache, major and minor injuries in the form of bodily cut, common cold, dislocation, sleepless nights and eye infections have also been identified. Below is an extract from the field:

“The stone business is a risky job to our health. We suffer many health problems such as injuries and snake bites, Also, a lot of dust enters our nose and small particles of stones often enter our nose and mouth. All these give us respiratory problems and diseases”

Discussions

Comparative Analysis

It is important to do a comparative analysis of findings made from Daglama with other existing findings of other scholars. Birabwa (2006) argues that rural dwellers seek

livelihood opportunities in the primary and informal sectors of the economy especially subsistence agriculture, small scale mining and quarrying. He pointed out that high unemployment rate contributes to stone quarrying in Uganda. Data collected from the field is consistent with this assertion as workers in Daglama outlined factors such as economic hardship, unemployment, and rural-urban migration as some reasons for their engaging in stone quarrying. Similar views were also expressed by Kuntala Lahiri-Dutt (2006).

Kitula (2004) maintained that stone quarrying has environmental and health effects. In the same vein, Sati (2015) held the view that quarrying, whether small or large scale, is inherently disruptive to the environment. Similarly, Nartey et al (2012) argues that stone quarrying causes land degradation. These assertions are consistent with findings made in Daglama. For instance, data gathered from the field revealed that land degradation, erosion, destruction of forests, destruction of arable land, destruction of ecosystem in terms of animals and plant species have been some of the negative effects of stone quarrying in Daglama. These findings resonate with the reviewed literature.

In addition, Langer (2001) maintains that 4 million people die yearly from acute respiratory problems in developing countries emanating from environmental pollution, sandblasting and emission of dangerous chemicals. Similarly, Abate (2016) also identifies physical injuries, respiratory problems and fatal accidents as some health challenges that confront workers in the quarry industry. Data collected from the field is once again consistent with these findings as body, waist and chest pains, snake bites, inhaling of

polluted air were identified as health hazards of stone quarrying.

The findings of this research further corroborate other related works. For instance, Gale and Groat (2001) argue that stone quarrying contributes to noise pollution, vibration, chemical spills, erosion and sedimentation. Although we did not find chemical spills in the quarry site, noise pollution was found to be one of the reasons why animals have migrated to the Kalakpa Reserve. In addition, there is absence of water pollution as there are no rivers in the Daglama community. Furthermore, contrary to Langer (2001)'s view that stone quarrying leads to sandblasting, and emission of dangerous chemicals into the environment, the case of Daglama is different as the workers do not use any chemicals and they do not use heavy equipment and machinery in their operations.

These differences therefore bring to light that stone quarrying is cultural and environmental specific. The nature of the environment and the available assets (land, equipments, skills etc) determine the kind of quarrying strategies to be adopted. Indeed, workers in Daglama use simple tools and other traditional methods in search for stones and rocks for their business. They use simple tools such as hoes, cutlasses, pick axe, shovels, spade and pans for their operations. Some men also use the flame burning method to soften the rocks before breaking them into fragments for further cracking into smaller units. This is totally different from findings from the Krobo, and Kumasi areas as outlined by Nartey et al (2012) and Asante et al (2014) respectively where heavy machines and chemicals are used in stone quarrying operations.

Conclusions

Stone quarrying is regarded as a crucial economic activity for the rural poor in Ghana. Though it plays a significant role in the sustenance of livelihoods, it also has a significant negative impact on the environment. Findings from the field revealed that economic hardship, unemployment, rural-urban migration, lack of compensation among others are factors that contribute to peoples' engagement in stone quarrying in Daglama. In spite of the hazardous nature of the work, data collected from the field revealed that it sustains livelihood in terms of employment and family income. This consequently contributes to the well-being of workers and their families. However, it has been observed that stone quarry has negative implications on environment. In Daglama, it has contributed to land degradation, erosion, destruction of forests, arable lands, loss of habitat for some animals and plant species as well as air pollution. This adversely affects the ecological balance of the area. Finally, it has also been observed from the field that stone quarrying in Daglama is not devoid of health problems. Eye problems, bodily pains, chest problems, coughing, respiratory problems, scorpion and snake bites and injuries are some health challenges that confront workers in the industry. It is therefore concluded that though stone quarrying contributes significantly to livelihood survival, it has greater health implications on workers in the industry.

The Way Forward

Following the adverse impact of quarrying in Daglama, the study recommends that the Environmental Protection Agency (EPA) should register and monitor the activities of the

workers to contribute to national development through payment of taxes. It should further ensure that the Daglama land is reclaimed with fertile soil to enhance agricultural activities. The health hazards could also be mitigated through the use of protective equipment such as goggles and hand gloves at the quarry site. The flame burning method, in which unused tires are used should be stopped due to the health danger they pose to the workers. It is important that the Wild Life Division of the Ho Municipal Assembly should take quick measures to ensure that hunters do not kill animals in the Daglama forest.

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References

- Abate, Z.** (2016), *Impacts of Stone Quarrying on Environment and Livelihood of Local Community in Addis Ababa Peri-Urban Areas: The Case of Hana Mariam Cobble Stone Quarry Site*. Unpublished MA Dissertation presented to the Department of Geography and Environmental Studies, Addis Ababa University.
- Asante, F., Abass, K., & Afriye, K.,** (2014), Stone Quarrying and Livelihood Transformation in Peri-Urban Kumasi. *Research on Humanities and Social Sciences*, Vol. 4, No. 13, 93 – 108
- Bauer, A. M.** (1991), *Mineral Resource Management Programs and the Construction Aggregate Industry*, Lansing, Mich.
- Beder, S.** (2000), *Costing the Earth: Equity, Sustainable Development and Environmental Economics*. Faculty of Law, Humanities and Arts, University of Wollongong, Australia – Faculty of Arts – Papers (Archives).
- Birabwa, E.** (2006). *Small-Scale Stone Quarrying: Its Contribution to People's Livelihoods, A case study of Kasenge Parish, Nama Sub-County, Mukono District (Uganda)*. An unpublished Master of Philosophy Thesis submitted to the Norwegian University of Science and Technology, [Online] Available at: <http://ntn-u.divaportal.org/smash/record.jsf?pid=diva2:125974> (September 28, 2012).
- Blaikie, P., Cannon, T., Davis, I., & Wisner, B.** (1994). *At Risk: Natural Hazards, People's Vulnerability and Disasters*. London: Routledge.
- Brajesh, J.** (2006). Rural Non-Farm Employment in India: Macro-trends, Micro-evidences and Policy Options. *IEG Working Paper Series No. E/272/2006*
- Carney D.** (ed) (1998), *Sustainable Rural Livelihoods. What contribution can we make? Papers presented at the DFID "Natural Resources Advisers" Conference, July 1998. DFID, London*
- Chambers, R. & Conway, G.R.** (1992). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. IDS Discussion Paper 296*. Brighton, UK: Institute of Development Studies.
- Chizoro, J.C., Jamare J., Kanodereka S., Mkusha S., & Munyaradzi C.** (1997), *A Study of the Environmental Impacts of Black Granite Quarrying in Mutoko District*, Department of Natural Resources and Department of Mines, Ministry of Mines, Environment and Tourism, Harare.

- Coppin, N.J., & Bradshaw A.D.,** (1982), The Establishment of Vegetation in Quarries and Open-pit non-metal Mines, *Mining Journal Books*, London, 112 p.
- DFID** (1999). *Sustainable Livelihoods Guidance sheets 1-4*. Department of International Development: London.
- Ellis, F.** (2000) *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press.
- Fellmann, J. D., Getis, A. & Getis, J.** (2005). *Human Geography: Landscape of Human Activities, Eighth Edition*, McGraw-Hill Companies, Inc. New York, NY10020.
- Gale, A.N. & Groat, C.G.** (2001), *Potential Environmental Impacts of Quarrying Stone in Karst*. US Geological Survey (<http://pubs.usgs.gov/of/2001/ofr-01-0484/ofr-01>)
- Gamal El-Dine H. M., Sadek, R. R., Zayet, H. H. & Refaat, T. M.** (2009), Respiratory Problems among Workers Exposed to Quarries dusts in El-Mina Governorate. *El Mina Med. Bull*, 20 (2) 360
- Ghana Statistical Service** (2008), *Ghana Living Standards survey Report of the Fifth Round (GLSS 5) GSS*, Accra.
- Ghana Statistical Service** (2010), "Population and Housing Census" PHC, Accra
- Helmore, K., & Singh, N.** (2001). *Sustainable Livelihoods: Building on the Wealth of the Poor*. Connecticut, USA: Kumarian Press
- Ibrahim, T. Z.** (2007). *Towards a Sustainable Quarry Industry in Malaysia: Some Issues and Challenges in Malaysia*. [Online] Available at: <http://www.opendor.com> (September 28, 2012).
- IEG (The Independent Evaluation Group) of world bank** (2008) Environmental Sustainability.
- Kitula, A.G.N.,** (2004) The Environmental and Socio-Economic Impacts of Mining on Local Livelihoods in Tanzania: A Case Study of Geita District. *Journal of Cleaner Production* Vol. 14, 405 - 414
- Lad, R.J. & Samant, J.S.** (2014), Environmental and Social Impacts of Stone Quarrying: A Case Study of Kolhapur District. *International Journal of Current Research*, 6 (3), 5664-5669
- Lahiri-Dutt, K.** (2006). Gendered Livelihoods in Small Mines and Quarries in India: Living on the Edge. *Working Paper Rajiv Gandhi Institute for Contemporary Studies and Australia South Asia Research Centre*.
- Langer, W.H.** (2001). *Potential Environmental Impacts of Quarrying Stone in Karst - A Literature Review*. [Online] Available at: <http://pubs.usgs.gov/of/2001/ofr-01-0484/ofr-01-0484textonly.pdf> (September 29, 2012).
- Maponga, O. & Munyanduri, N.** (1998), *Environmental Impact of Quarrying on Otere Village, Odeda, South Western Nigeria*.
- Nartey, V. K., Nanor, J. N., & Klake, K.R.** (2012), Effects of Quarry Activities on Some Selected Communities in the Lower Manya Krobo District of the Eastern Region of Ghana. *Atmospheric and Climate Sciences*, 2. 362-372
- Osiruemu, E.** (2007), Poverty of Parents and Child Labour in Benin City, Nigeria: A Preliminary Account of its Nature and Implications. *AERC Research Paper 156, June*
- Sati, V. P.** (2015), Socio-Economic and Environmental Impacts of Stone Mining in Shivpuri District, Madhya Pradesh, India. *Journal of Scientific Research & Reports*, 4, 47-54
- Sreenivasa R.V. & Ravanu, R.** (2014), Socio-Economic and Environmental Perception of Inhabitants of a Quarry Area: A Case

- Study of Bidadi, Bangalore Rural District. *International Journal of Engineering Science Invention*, Vol.4, 3. 11-22
- Stehouwer, R. C., Day, R.L., & Macneal, K. E.** (2006), Nutrient and trace element flux following surface mine reclamation with biosolids. *J. Environ. Qual.* **35**:1118-1126.
- Togunde, D.** (2006), Child Labour and Educational Outcomes in Urban Nigeria. *Research Journal of International Studies*, **2**: 4 - 22
- Ukpong, E.C.** (2012), Environmental and Social Impacts of Stone Quarrying-A case study of Kolhapur district, *International Journal of Current Research*, Vol.6, Issue,03, pp.5664-5669,
- Valdivia, C., Dunn, E., & Jetté, C.** (1996). Diversification, a Risk Management Strategy in an Andean Agropastoral Community. *American Journal of Agricultural Economics*, **78** (5): 1329-1334
- Wang, L., Zhang, J. L. & Liu, L.M.** (2010). Diversification of Rural Livelihood Strategies and its Effect on Local Landscape Restoration in the Semiarid Hilly Area of the Loess Plateau, China. [Online] Available at: www.wileyonlinelibrary.com (September 28, 2012).
- Wells, J.** (2000). Environmental Concerns and Responses in Small-scale Stone Quarries in Nairobi, Small Enterprise Development, Nairobi, Kenya. [Online] Available at: <http://www.igentaconnect.com/content/itpub/sedv/200/00000011/00000002/art0004> (February 2017)
- World Bank** (2001). *Attacking Poverty: World Development Report, 2000*, World Bank, Washington D.C