

Exploring Stone Quarrying in the Kambui Hills North Forest Reserve (KHNFR) in Kenema District

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Abstract— Stone quarrying is a livelihood source for most people residing in urban and rural communities closed to cities. This study aimed at exploring stone quarrying in the Kambui Hills North Forest Reserves (KHNFR) in Kenema District. Descriptive survey design was used and the study area was purposively selected because it had all the variables needed for the study. For data collection, simple random sampling technique was used. Fifty-five (55) stone quarried miners were randomly selected. Equally so, five (5) key informants were purposively selected because they were staying in the quarried communities and knew all the stone quarrying sites. One (1) staff from Environmental Protection Agency (EPA), Two (2) District Forest Officers (DFO) and two (2) local chiefs in the quarried communities. In total sixty-five (65) respondents were selected. Survey questionnaires and observational fact sheet was used. Data was analyze by simple graphs. Findings reveals that respondents of youthful ages were highly engaged in stone quarrying than others in different age brackets. It was also discovered that there were more stone quarrying sites in the KNHFR by Buwaihun and Kordebortihun forest edge communities. However, it was discovered that three methods were used which included digging, heating, and wedging which were all traditional methods of stone quarrying. It was concluded that KNHFR have lost and will continue to lose its biodiversity and landscape to stone quarrying if not stopped or controlled by duty bearers. Recommendations provided ranges from development of forest management plan to reclamation or rehabilitation of stone quarry sites in the KNHFR.

Keywords— Kambui Hills North Reserve Forest, Stone quarrying, Wedging, Buwaihun, and Kordebortihun.

I. INTRODUCTION

Quarrying is a process of taking out stones from natural rock beds. The word quarrying in stone excavation also indicate the exposed natural surface of rocks and the stones quarried are used for building and other purposes. Susmita, B. (2019) differentiated between mine and quarry as the former being an operation carried out under the ground at great depth while the latter being an operation carried out at ground level in an exposed condition. This work is focused on stone quarrying. To Langer, (2001), quarrying originates from a Latin word 'Quadraria' which means a place where stones are extracted. Therefore, stone quarrying was defined by him as the extraction of stones or slate from an open surface quarry. Stones collected from quarry sites are used for various engineering purposes such as building, road construction etc. Quarrying of stones are generally done at hilly areas where large quantity of stones are available. During the process of quarrying for stones, large amount of waste are produced such as sand and gravel quarries.

In other quarrying sites significant amounts of waste material such as clay and silt are produced (Wang, 2007). There are various ways stones are quarried including quarrying with hand tools through the following processes; digging/excavation, heating and wedging, with channeling machines by steaming, compression air or electricity; and quarrying by blasting through the use of explosives. Small-scale stone extraction is an important source of subsistence in rural Kenya, according to Wells (2000), despite the risks it poses to the environment and other relevant livelihood activities such as farming and other agricultural productivity. Forest reserves are portions of state land where commercial harvesting of wood products is excluded in order to capture elements of biodiversity that can be missing from sustainably harvested sites. World Bank, (2002) pointed out that less than one (1) billion people depend on forests for their livelihoods at various degrees. The KHNFR is a reserve that has suffered greatly from unsustainable exploitation of its resources ranging from logging to illegal mining of stones, gold etc. Following rapid expansion of Kenema city, there has been extensive and uncontrolled infrastructural and housing development projects carried out tampering with the KHNFR. There has been a need for stones for the construction of the city in which bulk of the stones used were extracted from various quarries in the reserve forest. Quarrying for stones in the KHNFR has negative impact on its biodiversity, landscape, habitats etc as supported by the work of Anand (2006) which stated that one biggest negative impact of quarrying on the environment is the damage to biodiversity. Although the work of Langer (2001) pointed out that quarrying contributes to economic growth as it involves both genders in different parts of the world; Mwangi (2014) postulated that in most African countries, the most undesirable environmental outcomes such as soil erosion and loss of rich biodiversity are largely attributed to active and abandoned quarry sites. This shows that stone quarrying in whatever form has negative impacts on the quarried communities and more importantly forest reserves. For Sati (2015), quarrying whether small or large scale is inherently disruptive to the environment. The alarming rate at which deforestation and land degradation mainly in forest reserves coupled with land grabbing and weak forest governance are threatening, the forest ecosystem and its resources are exposed to various risks. In a situation where stone quarrying in the KHNFR does not directly remove habitats by excavation, they can be indirectly affected and damaged by various environmental impacts including ground

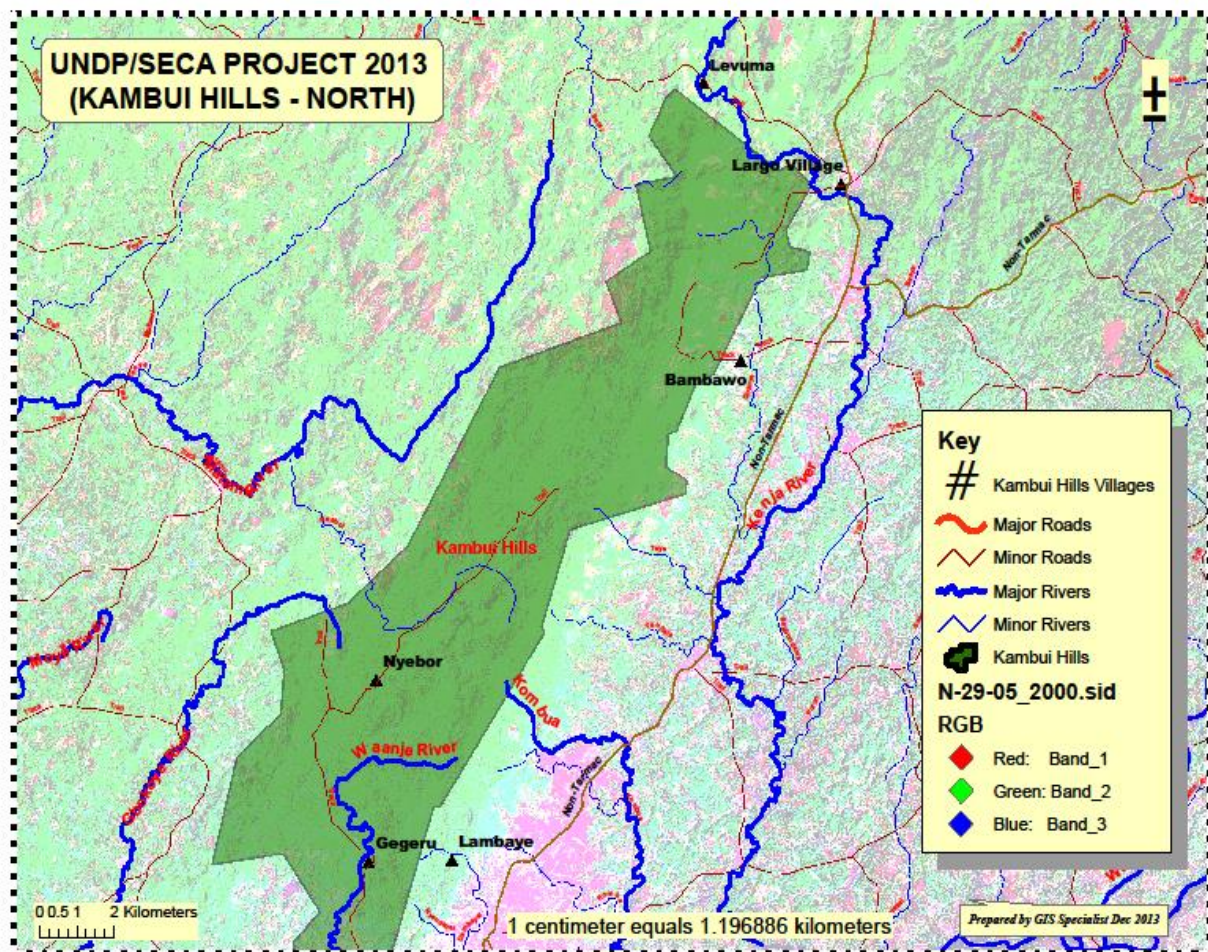
water contamination, destruction of water sheds, flooding and depletion, noise pollution, and erosion. It is difficult to change the livelihood of people dwelling in forest fringe communities but their livelihoods can be controlled to suit sustainable forest management activities. On this backdrop, this study seeks to explore stone quarrying in the KHNFR in Kenema District, Eastern Sierra Leone.

II. METHOD AND MATERIALS

2.1 Description of Study Area

Kambui Hills North Forest Reserve (KHNFR) is found in Kenema district, 306 kilometers (191 miles) from the Country’s

capital Freetown. KHNFR forms series of plateau characterized by flat tops and steep sides with variable topography running on the south-west to north east direction. This lofty highland reserve forest has a maximum elevation of 425m above sea level. KHNFR lies between Latitude: 7° 51’ 20.39’’ and Longitude 11° 19.16.20’’W (Vymaps.com). The reserve occupies an area of 14,335 hectares and is located ten (10km) kilometers from the city of Kenema. The communities surrounding KHNFR are predominantly subsistence farmers and bulk of them depend on the reserve for their livelihood. PLATE ONE: Map of Kambui Hill North Forest Reserve



SOURCE: Map adopted from UNDP/SECA Project, 2013.

2.2 Methodology and Tools

Descriptive research design was used. It is a design that aims to obtain information to systematically describe a phenomenon, situation or population. It helps to answer the what, when, where and how questions regarding the research problem. It has an advantage in that is fast and cost effective. It also have high external validity. However, it has a disadvantage because it relies on the responses of people, especially when conducted using surveys. In such situation there may be instances when people provide false responses and this will

compromise the validity of the data collected and ultimately the results of the research. This research was carried out in KHNFR where stone quarrying was carried out and therefore purposive random sampling was done to select the study communities. Stratified random sampling technique was used to sample the respondents. Fifty-five (55) were sampled by stratified random sampling thus, ten to twenty (10-20), twenty-one to thirty (21-30), thirty-one to forty (31-40), forty-one to fifty (41-50), and fifty and above (50+) years. Five key informants were purposively selected because they were permanently residing in the quarried communities and knew the sites. One (1) Staff from

Environmental Protection Agency (EPA), two (2) from District Forest Office and two (2) local chiefs from the selected communities. Survey questionnaire and observation fact sheet were used as tools to collect data from the field. Data analyzes was done by the use of descriptive statistics such as simple graphs and frequency tables

III. RESULT AND DISCUSSION

3.1 Age Bracket of Respondents

Figure one presents age bracket of respondents working in stone quarries in KHNFR. According to the below figure, 39% of the respondents stated that they were within the age bracket of 21-30 years, 31% of them indicated 10 -20 years while 18% claimed that they were within the age bracket of 31-40 years. The highest percentage of respondents working in stone quarries in KHNFR were young adults of productive ages. They were energetic for agricultural activities but due to the rapid growth of Kenema city, they have abandoned rural farm communities in search of better livelihood in the city which was not readily available. This forces them to embark on stone quarrying. The second largest group of respondents working in quarries in KHNFR were children of school going ages. From observations and information from key informants, bulk of them left school at earlier ages to assist their parents/guardians

in quarries or abandoned their homes for independent life. However, a few claimed that they were in schools but always join their relatives at the quarries after school having limited time to study. It was also discovered from key informants that bulk of them were not in school as they claimed. This is regarded as child labour, human right abuse and deprivation. This is against child’s right policies and regulations as pointed out in the International Programme on the Elimination of Child Labour (IPEC, 2002) stating that child labour works against human rights and investment in human development, against the provision of decent work and against the reduction of poverty. Children working in stone quarry is not limited to the study communities alone as the U.S. Department of Labour, (2004) stated that child labour is used in stone quarrying in many countries in Africa, Asia and Latin America. Those children work without adequate protective equipment, clothing or training and were engaged in breaking stones with pick axes, carrying heavy load of stones etc. However, 9% of the respondents stated that they were within the age bracket of 41-50 years and 3% indicated 50 years and above. Respondents above the age of fifty (50) were also working in stone quarries in the identified quarry sites in the KHNFR. From personal observations, they were group heads and had authority over the group at each sites.

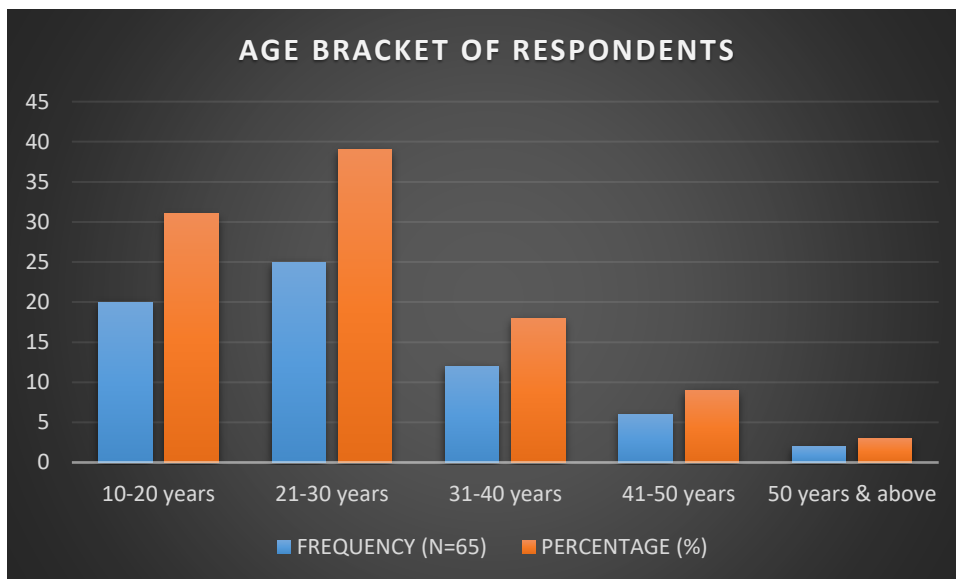


Fig. 1.

SOURCE: Survey Data, 2022.

3.2 Number of Stone Quarry Sites in the KHNFR Discovered

Selected Forest Edge Community	Number of Identified Stone Quarry Sites in KHNFR
Fonikoh	3
Nyandeyama	2
Kordebortihun	5
Buwaihun	6
Government Reservation Area by 'Dorwaila'	4

SOURCE: Survey Data, 2022.

The above table shows number of identified stone quarry sites in KHNFR that were very close to the selected forest edge communities. According to the table, twenty (20) stone quarry sites were identified and visited in the KHNFR. The sites included abandon quarries and those presently worked in. There were more stone quarries in the KHNFR by Buwaihun and Kordebortihun forest edge communities as shown in figure two (A&B) and bulk of those respondents working in the stone quarries were residents of the selected communities (children, males and females). This had negative impact on the forest ecosystem and landscape.



Fig. 2A. Buwaihun stone quarry



Fig. 2B. Kordebortihun stone quarry

holidays. Whatever form stone quarrying in the KHNFR has taken, it needs to be done in a sustainable way because some plants and animals are dislodged during the process. Endemic species of both plants, animals etc. and their dislodgment leads to their extinction. Similar caution was provided by Adeola (1991) who asserted that nature has provided wildlife and biodiversity with certain form of habitat and not as adaptable as man to the surrounding. This is a good pointer to DFO and EPA staff to inform policy.



Fig. 3A. Quarrying by wedging method at Fonikoh forest edge Community



Fig. 3B. Quarry site reclaimed at Fonikoh Forest edge community.

This appalling situation was condemned by the work of Darwish, et al., (2010) which stated that in most African nations and other nations, quarrying is not well managed for environmental sustainability. There were only two active stone quarries identified in the KHNFR by Nyandeyama community because bulk of the quarry sites have been reclaimed and settlements constructed beyond the red belt demarcating the boundary of the reserve. This means the forest reserve has been encroached seriously by the community. Government Reservation Area (GRA) mainly by “Dorwaila” had four stone quarries and they were all operational. Fine granite stones were quarried from the identified sites and it was known for granite stone trade by residents of the city. Information from key informants stated that, stone quarrying in the KHNFR in the selected communities had been stopped by District Forest Office (DFO) and Environmental Protection Agency (EPA), and several raids were carried out but the activities continued all the more. This was verified by the local chiefs, DFO and EPA respondents, but accusing fingers were pointed at weak implementation of laws, policies and regulations to persecute perpetrators.

Three (3) stone quarries were identified and visited in the KHNFR by Fonikoh forest edge community and were all operational as shown in figure three.

Key informants revealed that settlements at the foot of the reserve were once stone quarried sites but were reclaimed. This shows how stone quarrying in the KHNFR is providing opportunity for land grabbers to encroach more on the reserve. EPA and DFO staff were reported making efforts to stop stone quarrying in the reserve but it was done at either night, early morning hours or holidays when they Officers were on

3.3 Methods Used by Respondents to Quarry Stones in KHNFR

Figure four presents various methods used by respondents to quarry stones in KHNFR. When asked the method often use to extract stones at the identified sites in the KHNFR, 46% of the respondents stated digging method, 31% of them indicated heating while 23% claimed the use of wedging method. Observations of stone quarrying activities carried out in KHNFR were done in three ways due to their lack of advanced technology. Rather, it was done by local hand tools. Digging or excavating method was used where stones were buried in the earth or under loose overburden soils like those found in the KHNFR by Nyandeyama forest edge community. It was done by the use of pick axes, crow bars, hammers etc. Key informants revealed that, most of the tools were either borrowed or hired. Whatever materials/tools used by the respondents, had negative impact on KHNFR ecosystem and landscape.

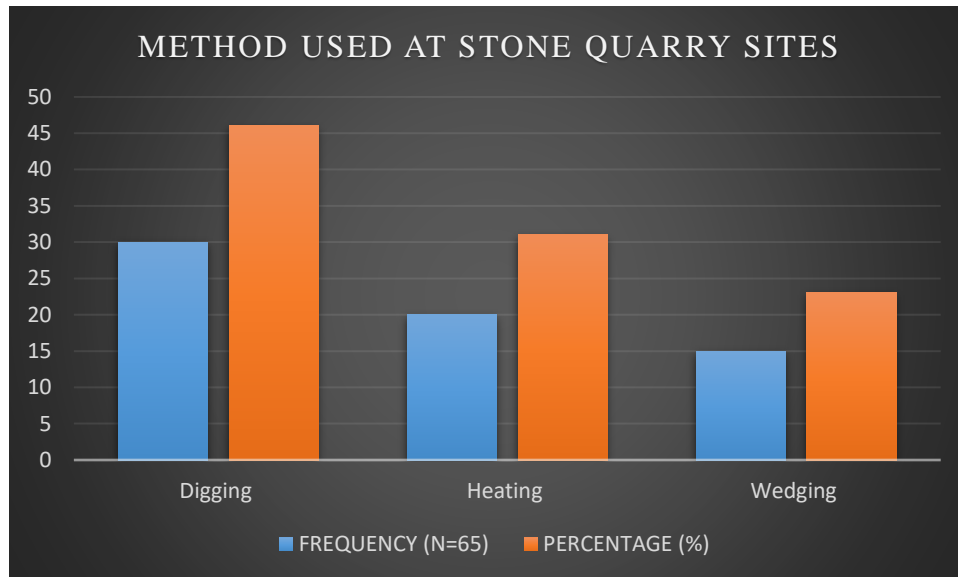


Fig. 4.

SOURCE: Survey Data, 2022.

This is in line with the work of Mabogunje, (2008) who postulated that quarrying carries the potential of destroying habitats and the species support. At some stone quarrying sites visited in the KHNFR mainly by Kordebortihun and Buwaihun forest edge communities, wedging method was used to extract stones. This method was used in the sites because the rocks contained cracks or joints where steel wedges were put in the cracks and continuously hit with a hammer. The third method used was heating the top surface of rock by placing wood with fuel on it. By heating portion of the rock is removed by the use of pick axe, crow bars etc. This had impact on the health of the workers. This is in line with the work of Langer (2001), who maintains that four million people die yearly from acute respiratory problems in developing countries emanating from environmental pollution, sandblasting, and emission of dangerous chemicals. Key informants revealed that most of the respondents working in the stone quarry sites in the KHNFR had experienced the stated health hazards. It was also reported by DFO and EPA staff that most of the tools they worked with were seized and store in the office but they went in for new tools as long as the city continue to buy stone from the them.

IV. CONCLUSION AND RECOMMENDATIONS

Stone quarrying have changed since the first quarries were mined in the Aswan area of Egypt. The earliest quarries were mined with hammers, pick axe etc. now advance technology have changed this activity extending it to forest protected areas and reserves. This have created several environmental, social and economic problems in the mined communities. The KHNFR is losing its biodiversity and landscape due to indiscriminate stone quarrying due to lack of effective protection, management and weak enforcement of policies. As new quarry sites were opened up in the reserve, people encroached on the all important reserve thereby losing its intended reserve purpose. To maintain and manage KHNFR

reserve as initially intended, the following recommendations should be implemented:

- That government Ministries, Departments and Agencies responsible for the protection of forest reserves or protected areas take responsibility of controlling negative quarrying in the KHNFR in Kenema District.
- That for the dream of resource diversification be realized, the creation of employment, environmental education and awareness should be capacitated.
- Local chiefs, forest edge communities, DFO, EPA and the Kenema District and City Councils should ensure that forest co-management plan is developed and owned up by all stakeholders so that the management and preservation of KHNFR should be a responsibility and concern of all.
- Finally, reclamation or rehabilitation of used up quarries should be carried out in the KHNFR to enhance quality environment once lost to stone quarrying.

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