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Assessing the Impact of Stone Quarrying on the Landscape, Crop and Grazing Land Degradation in Loma Bosa District, Dawuro Zone, Southern Ethiopia

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ABSTRACT

A quarry is a type of open-pit mine from which rock or minerals are extracted. The end product materials from the quarries include marble, gravel, granite, dimension stone and limestone which are regarded as inevitable in modern civil engineering and construction works. The main objective of this research was analysis of the impact of quarry on land escape, crop land, crop yield and grazing land in local resident. The study area is located in southern region, Dawro zone, Loma district, (Ethiopia), In addition, questioners were prepared both close and open ended type to deal the impact of quarry on resident; around the quarry site , with in the quarry and to analyses the impact and its beneficial use for generation of income from quarry. The questioner survey analyzed through frequency percentage and shows the impact becomes maximum during its operation. The data were collected from different target groups in order to get the actual information about impacts of quarrying. We have analyzed the data by using tables and percentage interpretation; quarrying has substantial impacts on the socio-economic activities and on the physical environment (during land clearing and excavation activities). It also substantially reduces crop and forage land which would, in turn, affects economic, social and ecological. Generally the quarry operation leads to destruction and degradation of the land, air pollution, accident, land escape change, and crop land change. we have seen the socio economic impact, impact on the land escape, impact on the crop yield and the environmental impacts of quarrying.

Keywords : Soil and Water, Soil Productivity, Soil Quality, Sustainability, Management

I. INTRODUCTION

1.1 Background

During the last 30 years, the production and use of building stone has steadily increased worldwide, and today stone has reached a position as one of the world's most important mineral resources for many countries (Hayleyesus, et al, 2000).

A quarry is a type of open-pit mine from which rock or minerals are extracted. The end product materials from the quarries include marble, gravel, granite,

dimension stone and limestone which are regarded as inevitable in modern civil engineering and construction works. It is also known that stones, over the century have played vital roles in the entire lives of the human race. It supplies mineral to meet many of the societal needs, since stone products are needed essentially in concrete buildings such as houses, bridges and roads. Quarried blocks of stones are used when cut, shaped and carved for facing buildings. Hence, quarrying being the only source of these raw materials is a major activity in many parts of the world where mineral deposits such as hard rock and sand and gravel are available.

Land degradation has a wider scope than both soil erosion and soil degradation in that it covers all negative changes in the capacity of the ecosystem to provide goods and services (including biological and water related goods and services – and in LADA's vision - also land-related social and economic goods and services(FAO,2018).Soil degradation is the decline in soil condition caused by its improper use or poor management, usually for agricultural, industrial or urban purposes including mining. It is a serious environmental problem. Soil degradation is the physical, chemical and biological decline in soil quality. It can be the loss of organic matter, decline in soil fertility, and structural condition, erosion, adverse changes in salinity, acidity or alkalinity, and the effects of toxic chemicals, pollutants or excessive flooding (NSW, 2018).

For some nations it is the main sectors by contributing income for their GDP. However, it has been perceived in many ways that quarrying has quite a number of effects on the environment. The environmental effects of quarrying include air pollution, noise pollution, water pollution and damage to biodiversity (Demola et.al, 2013). Air pollution causes nose and eyes irritations for humans and blocks and damages the internal structures of plants leading to stunted growth and sometimes death. The excavation of quarry minerals involves noise, particularly the blasting methods. Also, quarry involves the emission of significant amount of waste. These wastes can contaminate and imbalance freshwater ecosystem (Demola et.al, 2013).

Soil is a valuable resource that needs to be carefully managed as it is easily damaged, washed or blown away (State of Queensland, 2020). Land degradation is defined here as a process that lowers the productivity of the land (Jan and David, 1995). Mining activities degrade the soil's physical, chemical and biological properties (conserve energy future, 2018). Quarrying is on one of the stone mining, has quite a number of effects on the environment. The environmental effects of quarrying include air pollution, noise pollution, water pollution and damage to biodiversity (Demola et.al, 2013).

1.2 Statement of the problem

The growing attention on the interactions between development actions and their environmental consequences, and the issue of sustainability has become an overarching goal and frame of reference of conservation and development strategies. The quarry operation has wide range of problem which needs conducting research on the site (study area) to identify the degree of impacts and to take remedy measure. It is difficult to take a sustainable mitigation measure without detail investigation of the impacts. Moreover, the quarry is located within the urban center where there are institutions such as residential houses and school and, which can reinforce and diversify the problem. The process of quarrying has the following problems, sound pollution, air pollution, injury because of fly rocks, land escape change, land degradation (Enatfenta, 2007).

Quarrying (dimension stone) is a common and day to day activity of the communities in Gassa chare, Yalo

woribat, Ela Bacho and Tulama Tama Kebele, Loma district, Dawro zone south nation national regional state. Government of Ethiopia and the regional government have impact assessment strategies for any types of economic activities, especially if they have relation with the natural environment. This study is carried out to assess the impact of quarrying activities on the socio-economic activities, and the land escape in the kebele.

1.3 Objectives

1.3.1 General objectives

The main objective of this study is to assess the impact of quarrying activities on the physical environment of land and socio-economic activities of Loma district, Dawro zone, southern Ethiopia.

1.3.2 Specific objectives

- to identify the environmental components affected by querying practices
- To assesses the economic impact of quarrying in the Kebele
- To assesses the ecological impact of querying on the of the activities
- To assesses the social impacts of quarrying in the study area

1.4 Research questions

- What is the socioeconomic impact of quarrying in the study area?
- What is the environmental impacts of quarrying
- Which environmental components are highly affected by querying practices?

1.5 Scope and limitation of the study

The study aims to assess type of impact due to quarrying activities in the area. Its scope is limited to Loma Bosa district in selected Kebele. This is because of limited availability of resources and time; it is also limited to assess the physical impact of the activities.

1.6 Significance of the study

Its significance is to provide information for the stakeholders who are enabled to take effective measures and to feed it to the policy makers to improve the environmental and resource management strategies of the area and formulating mitigation measures.

II. METHODS AND MATERIAL

2.1 Description of the study area

2.1.1 Location

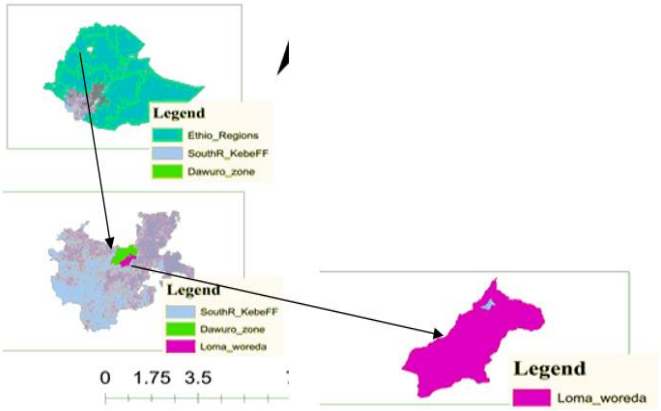


Figure 1: Map of study area

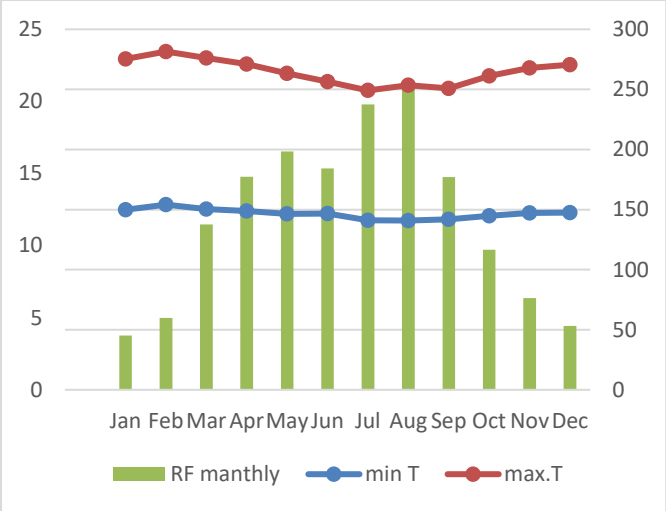
2.1.2 Population

According to Loma Bosa district plan and development office, there are about 1822 households (1534 male headed and 288 female headed) and total population of the selected Kebele is about 14,614. About 49.2% are males and the remaining 50.8% are females.

2.1.3 Climate

The district is divided into three climatic zones on the basis of altitudinal and annual rainfall variations, as "*Dega*," "*Woyna Dega*," and "Wet Kola". The study site belonged to "Wet Kola" and "*Woyna Dega*". The mean monthly rainfall, maximum and minimum temperatures for eleven years (2000-2010) are presented in Figure 2. The mean annual rainfall was 1720 mm and mean minimum and maximum temperatures were 11.7 and 23.5 ℃, respectively. The

rainfall distribution was bimodal. The medium rainy season (*Belg*) occurs from March to May, while the main rainy season (*Kremt*) occurs from June to September. Also, there is small rain in October and November.



2.1.4 Topography

The elevation of the study area range is 1342masl up to 2248masl. Most of the study area is dominated by undulating slope; the astronomical location of the area is 11.38 north latitude and 37.10 east longitude (GPS DATA)

2.1.6 Land use or production system

Study area production system is mixed farming of crop and livestock production. The land use system based on farming, grazing, forest and other. There is 4135ha of total area in the Kebele, cultivated, forest, grazing and other lands covered 71.3%, 11.4%, 10.8% and 7.3% respectively in the study area. Most, range land use, based on open grazing. Agriculture is characterized by subsistent mixed crop-livestock farming system. The important cereal crops were maize (*Zea mays*), sorghum (*sorghum bicolor*), barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*). The vegetables grown were potato (*Solanum tuberosum L.*), tomato (*Solanum lycopersicum*), cabbage *(B. oleracea var. capitata)*, onion (*Allium cepa*), carrot (*Daucus carota*), green pepper *(Capsicum spp.),* faba bean *(vicicia faba L.)*, pea (*Arachis hypogea*), and haricot bean (*Phaseolus vulgaris*). Most of the area around the homestead was covered with perennial Enset (*Enset ventricusem*), which is a staple food and income source. Coffee (*Coffee Arabica*) and fruit trees such as false banana (Musa species), avocado (*Persea americana*) and mango (*Mangifera indicia*) were also among the widely cultivated crops (LWFNRMO, 2017).

III.Methodology of the study

The study was intended to identify and describe data obtained from the sample Kebele of Tulama Tama, Gassa chare, Yalo woribat and Ela Bacho in Loma Bosa district to assess the impacts of quarrying activity on the land degradation, physical environment, crop and forage production, and socio-economic activities. Thus in this chapter the above mentioned concept (variable) were analysed with related selected background characteristics quantitatively and information obtained from the qualitative data. From a total 96 interviewed sample respondents who were randomly selected from the Kebele. All of them were interviewed and the analysis was made based on the data obtained from those respondents, focused group discussion, key informant and informal interview and observation

Based on the nature of the study, we used descriptive survey methods of research these types of research method are concerned with the gathering of information for the purpose of description and interpretation.

3.1 Data type, sources and data collection method

Both qualitative and quantitative data was collected from primary and secondary data source. Qualitative: - personal observation, informal and formal interview by using semi-structured and open ended questionnaires. The primary data was collected from development agent, land owners, excavators, users,

environmental stakeholders and direct interviewing these. The secondary data source is documents, office reports, published and unpublished materials, literature review and processing materials.

3.2 Sampling techniques

The study was conducted in Loma Bosa district at Tulam Tama, Gassa Chare, Ela Bacho and Yalo Woribati kebele. This Kebele is purposevely selected because to minimize time, transport cost etc. Then simple random sampling method is applied to select a total sample size and due to homogeneity in culture religion and language of the community in the study area. The general discussions and interviews were made with 96 randomly sampled respondents taken from total 1822 house hold people in watershed according to sampling formula (Glenn, (1992) $n = \frac{N}{1+N(e)^2}$ Where n=sample size N=total population, e is the precision level chosen (10% at 90 % Confidence level). confidences. $n = \frac{1822}{1+1822(0.1)^2} = \frac{1822}{1+18} = \frac{1822}{19} = \frac{1822}{19} = 96$

2.2.3 Method of data analysis

The data collected from the respondent were analyzed by using both quantitative and quantitative methods. The quantitative data were analysed using IBM SPSS statistics software version 20. Quantitative data was analyzed by descriptive statistical tools like frequency distribution, percentage and tables. Qualitative data was analysed by using techniques like narration and discussion and also the data was analyzed by direct observation on the impact of quarrying activities.

IV. RESULTS AND DISCUSSION

4.1. Demographic characteristics

The survey result indicated that the 96 sample respondent age ranged from 18 to 65 years and large numbers of respondents were found in age group of 21-30 years (39.6%) followed by 31-45 years age group (38.5%). The two ranges, accounting for 78.1% of respondents, fell in the productive age (Table.1)

Table: - 1 Distribution of respondents by demographic characteristics.

Respondents characteristics	Frequency	Percent
Sex ratio of respondent		
Male	67	69.8
Female	29	30.2
Age of respondent		
18-20	11	11.4
21-30	38	39.6
31-45	37	38.5
46-65	8	8.3
>65	2	2.2
Marital status		
Single	10	9.6
Married	77	80.2
Divorced/Widowed	9	10.2
Level of education		
None write and read	8	8.3
writing and read	11	11.5
grade 1-8	20	20.8
grade 9-12	32	33.4
diploma and above	25	26.0

Source; data own

Seeing the sex ratio, 69.8% were male and 30.2% female (Table 1). The high number of men in the field revealed that quarrying activity was mostly coordinated by men excavators in many families. In Ethiopia, men contribute immensely to the mining value chain by providing labor for excavating, transporting, and grinding processing and they account for a large number of the population. The observation agreed with that of Kebede Wolka & Mesele Negash (2014) who observed that men farmers contributed more to food production and family labour than women. The same authors found that over 95% of rural men were small-scale farmers who

produced most of the food needed day-to-day for family subsistence in Ethiopia.

Considering the status of sampled respondents, this study found that 79.2 % were married while 8.3% and 12.5% were respectively single, divorced /widows (Table 1). The married family and farmers in the age group of 31-45 years participated actively in agriculture than other categories of people.

The majority of the farmers were not highly educated. Among the respondents, 8.3% were illiterate, 11.5% could only write and read, 20.8 % were having grade 1-8 education, 33.4% having grade 9-12 education, and 26% percent were having diploma (Table 1).

Level of education is related to know the environment impact; hence literate farmers were in better position to get information and use it in such a way that it contributed in their environment management practice.

4.2. Participants on quarrying activities

Considering the status of sampled respondents, the distribution of job occupation (quarrying) mostly done in the study area, large investor, urban enterprise, rural enterprise and farmers were 33.335%, 30.21%, 25.00% and 11.46% respectively(Table 2).

Table 2 : Distribution of respondents by job occupation

Characteristic	Category	Frequency of respondents	Percentage of respondent
Job/occupation	Farmers	11	11.46%
	Rural enterprise	24	25.00%
	Urban enterprise	29	30.21%
	Large investor	32	33.33%

(Source-our survey, 2020)

The result indicated that urbanization and large investment like road construction and building taken high part on land degradation due to large amount of quarrying. In cause of Land degradation Loss of arable land, loss of grazing land, loss of biodiversity, Increased flooding, leads to water and land pollution.
On other hand 55.21% of respondents, responded that Rural and urban enterprise job occupation on stone quarrying in the area. This due to unemployment and jobless youth were to get income organized on enterprise on quarrying.
Some farmers also worked on quarrying activities on study area. The reason to farmers worked on quarrying may be income generation and to reduce the large stone from cultivation land.

4.3. Why practice quarrying

The most serious reason for quarrying, according to the response of the respondent, 22.91%, 39.58%, 26.04%, 3.12%, 8.33% of the excavator is excavate it in order to get money or income, need of construction materials, to decrease unemployment, Absence of legal frame work and Lack of awareness on land degradation respectively (table 3).

Table 3: Reason why farmers practice querying

Reason for quarrying	Frequency	Percentage (%)
	Yes	Yes
Income need	22	22.91%
Need of construction material	38	39.58%
Unemployment	25	26.04%
Absence of legal frame work	3	3.12%
Lack of awareness on land degradation	8	8.33%

(Source –our survey, 2020)

4.4. Environmental Impacts of Quarrying

According to the respondent, about 78.12% of the respondents believed that quarrying has negative impact and 21.88% of responded that quarrying has positive impact on the land use (Table 3). Majority of respondents considered quarrying to be severe negative impact on land use and caused considerable damage to cropland and grazing land. Some of respondents responded quarrying has positive impact on cropland due to harvesting large number of stone which affect the farming activity.

The result have similar with (Berry 2003)Land degradation negative impact in many different ways: vegetation becomes increasingly scarce, water courses dry up, thorny weeds predominate in once rich pastures, footpaths grow into gullies, and soils become thin and stony. All of these negative impacts have potentially severe impacts on the environment, for land users and for people who rely for their living on the products from a healthy landscape.

4.4.1. The Negative Impacts of Quarrying

According to the respondent, about the negative impacts of quarrying economic (crop yield loss, forage yield loss), social impact(air pollution, water pollution, health of people),ecological impact (landscape loss, soil structure stability loss, and biodiversity loss) was 22.92%, 18.75%, 8.34%, 6.25%, 13.54%, 12.5%, 10.425 and 7.28% respectively(table 4).

4.4.2. Economic impact

The crop yield loss is due to when the quarrying pit is excavated, it takes the crop land and there is also a buffer zone around the pit which is impossible for tillage (fig.2). The other reason for crop yield deceasing is the soil disturbance during pit excavation and stone transportation, at this time there is mixing of upper and inner part of the soil since the inner soil does not contain the appropriate soil nutrient, which are essential for crop growth and productivity. Temesgen et al 2014 similarly, reported land degradation is one of the major causes of low and declining agricultural productivity and continuing food insecurity and rural poverty.

Quarrying has great impact on the forage production and amount of yield. 17.75% of responded that in Loma Bosa district there was land use change because of quarrying activity. Intensive stone harvesting is a consequence of higher demographic pressure and land scarcity in Ethiopia. The higher demand for both construction material and cement material by the increasing population led to continuous exploitation of land. Quarrying activities change the grazing land to unsuitable for grazing and easy movement of cattle on it. Especially in the site of Gessa and Yallo the excavated place changed to high gorge.

4.4.3. Ecological impact

Quarrying has great impact on the land escape. 13.54% of responded that in Loma Bosa district there is land escape change because of quarrying activity, after quarrying the land going to unsuitable for cultivation and easy movement on it. Intensive stone harvesting is a consequence of higher demographic pressure and land scarcity in Ethiopia. The higher demand for both construction material and cement material by the increasing population led to continuous exploitation of land. Especially in the site of Gessa and Yallo the excavated place changed to high gorge. The impacts of quarrying on land escape gorge hole is happened due to excavation of deep pit in order to get huge amount of stone, at that time there will be land escape change due to the soil and the excavated pit, at the time of observation we have seen the depth of sample pit at the study area (3, 2.5, 1.5, 4, 3.25 meters deep) the average depth 2.85meter, due to this the impacts of this activities on the land escape is not easily avoidable. The other reason is that the excavator doses not refill the pit after quarrying. The biophysical change of the land is the cause land

degradation. Similarly Temesgen et al, 2014 reported Physical degradation (comprising crusting, compaction, hard-setting, etc.) were Principal processes of land degradation. Also the report similar to WMO (2005) that the causes of land degradation into biophysical factors such as unsuitable land use (land use for the purpose for which environmentally unsuited for sustainable use).

On the other impacts of quarrying ecological impact was soil disturbance. 12.5 percent of the respondent says quarrying can be case for soil disturbance. The impacts of quarrying on land productivity due to soil disturbance or structural instability, which affects the soil suitability and fertility. During our field observation we have taken measurement of pit size by taking samples of 6 pits randomly from the study area. According to our measurement (2.5, 3.2, 2.45, 2.65, 3.5, 3.25 diameter) the average diameter will be 2.93 meter, so average areas of the pit is, $A = \pi r^2$ =3.14 *$(2.93)^2$ =26.96m^2. So, quarrying take huge amount of land from the cultivated part and the minimum buffer zone length is about 2 meter.

4.4.4. Social problem

Impact on air quality due to quarrying is during excavation and transportation there is huge amount of dust emission, which affects the environment.

Others respondent worried about health problems due to quarrying. The impact of quarrying in air pollution by dust and water pollution by erosion was caused the health problem of the sounding people in the site. Chao et al, 2014 reported, in the past, soil contamination was not considered as important as air and water pollution, because soil contamination was often with wide range and was more difficult to be controlled and governed than air and water pollution. However, in recent years the soil contamination in developed countries becomes to be serious.

Table 4: Environmental Variables under the Impacts of Quarrying

Environmental Impacts of Quarrying		Frequency	Percentage (%)
Negative impacts		75	78.12
Positive impacts		21	21.88
Variables negatively effect			
Economic impact	Crop yield	22	22.92
	Forage yield	18	18.75
Ecological impact	Biodiversity loss	7	7.28
	Land escape	13	13.54
	Soil/stability	12	12.5
Social impact	Health of people	10	10.42
	Water pollution	6	6.25

(Source –Field survey, 2020)

The quarrying activities in the area are not manageable, there is no specified stakeholder, their target (excavator) is only gaining economic benefit, and they did not examine the other related problems of the activities. Quarrying activities in Loma Bosa district has different impacts on the communities (human health), environments (water, landscape, and land degradation), and crop productivities, and forage production) but there is no action which is taken to minimize the impact of these activities even if it needs great emphasis. Quarrying is a economically income generating activity in Loma Bosa district, but there were different problems which arise from this activity those can be negative and positive.

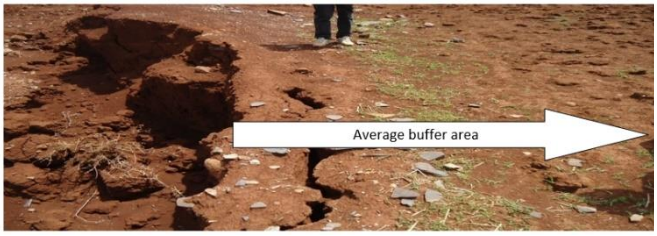


Figure 2:- Buffer zone lengths

Figure 3:- Lands which changed in to uncultivated and grazing due to quarrying

Figure 4:- Impacts of quarrying on grazing land

4.5. Mechanisms of mitigation measure degraded lands on quarrying site

Can mitigation the quarrying area?	**Frequency**	**Percent**
Yes	68	70.83%
No	28	29.17%
Type of practice		
Plantation of multipurpose tree	28	41.18%
Backfill the pit	6	35.29%
farm yard manure addition	24	8.82%
Combined use of practices	4	5.88%
Area closure	6	8.82%

(Sources: own sources, 2020)

The mitigation mechanism of land degradation were in quarrying site, responded that 70.83% yes and 29.17% no (cannot) mechanism of mitigation (Table 4). The respondent frequency result indicated majority (70.83%) understanding the mechanism of mitigation the land degraded by quarrying activities. Even if the majority of respondent understand the mitigation mechanisms, but the application on the ground is negligible. This, the mitigation mechanisms may need the capital and encouragement of environment protection authority.

According to the understood respondents of mitigation mechanism, the frequency indicated that the type of mitigation mechanisms were plantation of multipurpose tree, backfill, farm yard manure addition, combined use of plantation and backfill and area closure were 41.18%, 35.29%, 8.82%, 5.88% and 8,82% respectively(table 4). From the total 68 respondents majority (41.18%) responded multipurpose tree plantation was good way of mitigation mechanism. the double importance Plating multipurpose tree, the first mitigation measure and the next was tree used for different purpose.

The another mechanism understudied mechanisms by respondent were (35.29%) backfill of pit in quarrying area. This mechanism was applicable in area, where quarrying material used by large investment like road, dam and other construction area which have large hole. The Gasa kebele site was one type of quarrying area that quarry used by large investor by road contractors.

V. CONCLUSION

The study shows that most of the farmers, investor and enterprise directly or indirectly participate in quarrying activity in order to get income and construction material. However, quarrying has substantial impacts on the socio-economic activities and on the physical environment (during land

clearing and excavation activities) and/or ecological. It also substantially reduces crop and grazing land which would, in turn, affects crop and forage production. Generally the quarry operation leads to destruction and degradation of the land, air pollution, accident, land escape change, and crop land change.

VI. RECOMMANDATION

- ✓ The quarry activity need proper legal binding permit and regulation including environmental impact statement document which mention the environmental impact.
- ✓ The quarrying area should be separated from other area like cultivation, grazing, residential, road and the other.
- ✓ The society should be aware about the adverse impact of quarrying
- ✓ The excavator should refill the pit after excavation
- ✓ During the excavation it is better to watering the pit and area to prevent the dust emission
- ✓ The government need to apply immediate mitigation measure to minimize the environmental impact of quarrying

VII. ACKNOWLEDGEMENT

We would like to thanks all who were volunteer for our interview or the community of Loma Bosa district selected kebele, and agriculture office of the kebele, road and transport office, and water, mine and energy office

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Appendix

Questionnaires interviews

Personal information of the respondent

Name_____ title_____ department (jobs) ____

sex____ age ____ family size_____

Part I: - environmental protection agency (legal organization)

1) Are their legal policies about quarrying?

_____

_____

2) How do you see the environmental impact of quarrying?

_____

_____

3) What types of mitigation measures do you set to minimize the impact of quarrying? (by the agency)_____

_____

4) How can you estimate the environmental impact of quarrying (negative)?

_____

_____

5) Is there any new proposed policy to control the impact quarrying in Dawro?

Part II: - For the excavators' or labour

1)

o you think quarrying has a problem on the environment? a/ yes b/ no if yes, what is the problem do you think?

_____

_____

2)

o you think quarrying has a problem on the human? a/ yes b/ no if yes, what is the problem do you think?

3) When you have started quarrying? Is it your cultivated land? If no, do you have agreement with the land owner? What types is it?

_____

_____

4) What was your previous work?

_____

_____

5) cost of extracting one stone

_____

_____

6) How much do you get per day? Do you have other source of income? Or what is the main stay for your family?

_____

_____

7) Is it highly important for your life?

_____

8) If this quarrying is stopped, what will be your work/ do you have another job option?

_____

_____

9) Do you have legal permission?

_____

10) Have you ever faced problems with related to quarrying? Accident, health problems and the like

_____

_____

11) What do you think about the adverse impact of quarrying? Simple, heavy, not visible?

_____

_____

Part III:-for farmers or owner of quarrying site

1. How much hectare of land do you have?

_____

2. Is it suitable for quarrying?

_____

3. Do you excavate stone from your cultivated land? Do you permit for others? If yes the no. of pit/hectare? If you have permit, for how many person? How long years?

_____

4. How much birr do you earn from the excavators? From your land/ha/_do leave the pit open?

_____

5. What types of mitigation measures do you practice after quarrying, to minimize the impacts of the activities on the crop land?

_____

_____

6. How do you understand the impact of quarrying on the crop yield?

_____

_____

7. Do you observe the impact of quarrying on the crop yield before and after quarrying?

_____

_____

8. Which one is more profitable? Quarrying or crop_____

_____

9. Do you cultivate the land after quarrying?

_____

_____

10. Is there any problem which arises from quarrying pit?

_____

_____

Part IV:-for the area communities

1) Do you have quarrying site? If yes

2) What is your perception about quarrying?

_____

_____

3) Is it your first income source or not? If yes how much income do you get? Is it more or less than other income source?

_____

_____

4) Do you worried about impact of quarrying?

_____

_____

5) Is there any environmental change before and after quarrying?

_____

_____

6) What types of problems arises from the quarrying pit during summer season?

_____

_____

7) Is there any health problem in the area because of quarrying?

_____

_____

Part VI. Mitigation (management) practice

1/ Is there any environmental mitigation measure after quarrying? a/ yes b/ no

2/ if yes, what type of mitigation measure under taken on your area? a/ backfill b/ plantation c/ conservation measure d/ both
3/ which method of mitigation measure was best for you?
4/ who support the mitigation measure?

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