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## RESEARCH ARTICLE

# IMPACTS OF ARTISANAL GOLD MINING ON THE ENVIRONMENT AND COMMUNITY OF KAPE AREA, WEST GUJI ZONE, OROMIA, SOUTHERN ETHIOPIA

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### ABSTRACT

The study was to assess on the impacts of mining activities on land degradation, land stability, atmosphere, water resource, biodiversity and on local residents as well on local uses of mineral resources in Kape area. Data's employed were gathered through field observation, group discussion, and asking local peoples about impact of gold mining, their consequences and their activities in the study area. The operations that practiced in the study area characterized by shallow diggings some meters depth underground and on the surface, which follow the reefs. This activities means riverbed gold panning creates a number of serious environmental impacts such as land degradation, land stability, soil erosion, deforestation and impacts on both surface and subsurface water. Because the local people gets income daily from this activities and have high demand for gold leads to increase in mining activities which results in land use changes. Therefore, the government and its partners should make efforts to harmonize forestry and mining laws to avoid conflicts of interest which lead to sustainable management of both forest and mineral resources.

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## INTRODUCTION

Gold mining has been an important source of livelihood for rural communities throughout the world (Hinton et al., 2003; Mudd, 2007; Phillipson, 2006). The 'get-rich-quick' principle resulted in getting 15 million individuals involved in gold mining. Artisanal gold extraction has been an integral part of the economy for many developing countries (Nana & Jeff, 2016). Artisanal gold mining is a poverty driven activity practiced in the most remote rural areas of the countries in Africa and Asia (Seccatore et al., 2014). In the leading gold producing South Africa and Ghana, artisanal gold mining has brought economic success stories on booming national income (Phillipson, 2006). Similarly, in Tanzania, small-scale gold mining is perceived as a 'ladder that sends people to wealth' (Fisher et al., 2009). As a result, artisanal gold mining becomes a livelihood diversification strategy in third world countries. Artisanal gold mining affects hydrology at the artisanal gold mining areas in Africa (Bjerklie & Laperriere, 1985). In Ghana, 40 per cent of the groundwater resources have been destroyed by artisanal mining operations (Kuma, 2007).

Congruently, Mudd (2007) reported that artisanal gold mining disrupted the quality of surface water. This indicates that artisanal gold mining deteriorates surface and groundwater that risks livelihoods of marginal farmers in the downstream areas (Getaneh & Alemayehu, 2006). In this regard, artisanal gold mining has long been an environmentally destructive activity in Ghana, Tanzania, and Mozambique (Hilson & Van Der Vorst, 2002). It creates environmental stresses such as increasing sheet erosion, rill erosion, and gully erosion. Similarly, these erosion forms have increased in Zimbabwe (Frost, 2013) and Tanzania (Kitula, 2006; Mwakaje, 2012) because of low technical operations and absence of land rehabilitation at the abandoned gold mining sites. The physical effects of artisanal gold mining system could degrade fundamental soil properties (Kuma, 2007). We have limited studies about the socioeconomic benefits of small-scale gold mining in Ethiopia. In this regard, Meaza et al. (2015) inferred that traditional gold mining has positive and adverse effects on livelihoods of local communities, landless youths and migrants. Gold occurrences are widespread in Ethiopia and exploitation of placer gold dates back at least 3500 years (Phillipson, 2006). Notably, gold potential sites are confined to Precambrian basement rocks known as Northern, Western and Southern Greenstone Belts in Ethiopia. Ethiopia is endowed with a wide variety of industrial minerals.

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In the Southern part of Ethiopia, the artisanal mining is widespread at the many places. This artisanal gold mining is the source of income for the local peoples. However, gold panning has been the worst challenger of the environment for a long time and now it has been deteriorated by the persistent droughts that saw a lot of people going into panning as a source of employment (Geology Survey, 2000). Local miners use surface mining that is the dominant method of mining used by small-scale mining artisans due to its cost effectiveness, low capital intensity and minimal technical skill requirement. This small-scale mining was considered as illegal mining activities and was highly unregulated. In Kape, one of the mining communities in Bule Hora, increased mining activities have resulted in disproportionate contamination of major water bodies leading to loss of aquatic organisms, destruction of the biodiversity, removal of vegetation, depletion of soil resources and loss of farmland. The panning activities are mainly concentrated in rivers, disused mines which have threatened the water availability not for domestic use alone but also for livestock and irrigation purposes. Siltation is a big problem and open cast mines are also a big threat to animals, people and panners at times being trapped in disused mines with some dying and others injured in the process of gold panning. The major environmental impact of mining also includes erosion, formation of sinkholes, loss of biodiversity, and pollution of groundwater and surface water. Therefore, this paper is aiming to provide information on the impacts of artisanal gold mining on the environment and community, as well to create awareness about proper utilization of artisanal mining friendly with environment.

## MATERIALS AND METHODS

Kape area is located in between Kalaltu Say and Dibesa Ogo Kebele, Western Guji zone, Oromia regional state, southern Ethiopia and 489 km far from south of a capital city of Ethiopia, Addis Ababa. It is accessible through main asphalt from Addis Ababa to Bule Hora and rough road from Bule Hora to the study area (Fig 1). There is some of foot path for doing the quarry site work at the area. The area is characterized by some flat land and up down rag topography and by dry season from November to March and wet season from April to July with highly rainfall and slightly rainfall during August to October. The annual rainfall is ranging from 500 mm-2500 mm and temperature of ranging from 10°C-27°C.

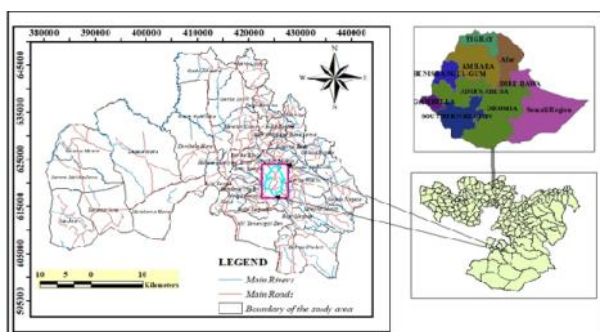


Fig. 1. Location and accessibility of the study area

The basic methodologies adopted to attain and achieve assessing and identification of impacts of mining activities included; collect and review of different literatures, field observations, photo documentation and mapping and artisanal mining measurement on Google Earth Satellite images, to assess the change and status of environmental impacts of

artisanal mining. A structured questionnaire to know the local people perceptions about the impacts of artisanal mining was administered in the field during study. Stratified random sampling techniques were used on the basis of different parameters, such as gender 75% males and 25% females were selected for the study. Stratification was also carried for based on age groups which include youth below 25 years (25%), adult between 25 to 50 years (50%) and seniors above 50 years (25%). Finally, compilation of field observations, field data collected and other previous work are integrated in all ways to assess impacts of artisanal mining activities and forward recommendation.

## RESULT AND DISCUSSION

The study area is mostly covered by quartzite and greenstone rocks and some rocks of mica and talc schists. Quartzite is abundantly covered the study area which is characterized by its white fresh color and yellow weathered color by having enormous thickness. However, greenstone rocks of the study area are found mostly by covering the quartzite rocks which have schistose texture. Impacts of artisanal mining on environment There are wide ranges of potential environmental impact caused by artisanal mining operation including landscape changes, change to the visual scene, erosion, noise, vibration, dust, effect on the amount and quality of water, high traffic and waste materials are the common problem in the development of artisanal mining operation.

**Impact on landscape and land Stability:** A landscape comprises the visual feature of an area of land result in extensive manipulation of the landscape and of the ecosystems of indigenous to their sites. Disturbance to the natural contour of the topography has repercussions, not only for those communities in the immediate vicinity, but also for those adjacent.



Fig. 2. Images shows land degradation

Artisanal mining presents prime conditions for accelerated erosion because the top soil environment required for establishment of stabilizing vegetation is eliminated. Once artisanal mining activities are exhausted or operations cease, the landscape has often been degraded to an extent that decolonization by pre-disturbance communities is difficult, if not impossible. The most obvious environmental impact of this mining work operation is the conversion of land use. Hence the operation involves wide range of activity starting from land clearing to excavation and making abandoned. All operation is in relation to the land and it will damage the different landscape. Generally the natural condition of the land is changed because of excavation and extraction of the material.

**Impact on the Atmosphere:** The effect of air pollution on health and environment is a growing concern worldwide. During winter season when the mining activity was worked fugitive dust would humbleness air quality in the surrounding area. Even with controls in place, dust generated by the mining activities would negatively impact the health and wellbeing of residents in the area. Different types of engine that used to dewatering associated with mining operations also result in reducing air quality in the surrounding area.

**Impact on Water Resource:** Both surface and groundwater impact are associated with the mining level of operation. Impacts appear to be significant if the working area lies completely within the watershed protected area. Moreover, the geological materials being extracted affect adjacent of water quality.

**Surface Water Impacts:** If the mining operation is near a river, spring and wetland area, the impact is more significant. The channel of river or spring can be changed and the quality become devastated based on the quarry property between the active pit and the production yard. Run off from the working yard and dewatering of the pit can produce pollutant discharge to the surface water such as on total flow settle solid, turbidity and total suspended solids. These are leading measure to pollution of the surface water. The pollution degree depends on the geology of the material extracted.

**Groundwater Impacts:** Groundwater impacts at the site depends on soils in the vicinity of the mining area, the underlying geology, amount of rainfall, the depth of the pit, the proximity of the pit to well and aquifer and working practice. If the groundwater availability is generally good in the operation area there may be amounts of water seeping in from zone extending throughout the full face of the quarry wall. Seeps come from groundwater migration through natural and working area induced fracture in the rock. The fractures can be continuous or capable of providing a path way for significance water leakage into or out of the area. The condition extending working place near the groundwater discharge area is expected to cause notable adverse groundwater impact.



**Fig.4. Impacts of quarry operation on biodiversity**

**Impacts on Biodiversity:** Biological resource impacts of the artisanal mining activities related primarily to the loss of habitat on vegetated lands, area of wetland, wooded habitat, and mixed habitat associated with preparation and construction of the new site or mining operation. Many area of study are covered with coffee and some hardwood trees. Various small mammals and resident and migratory birds can use the

habitat. When the habitats are deforested the useful wild life will be lost. This is eliminated due to mining activities. In general, environmental impacts associated with habitat loss, sedimentation and erosion from construction activities is expected. Hence the activities can lead to loss of flora and fauna.

**Social Impacts of Artisanal mining:** Characterizations of social, economic, and cultural impacts of mining work operation is relatively straight forward and consists of an assessment of past and current impacts and projected future effects of quarry operations at production levels. If the proposed quarry is in village or town center where surrounded by residential and recreational land of high scenic values, mining operation will negatively impact on these values. These operations are producing fugitive dusts from quarrying, vehicular emissions and other mining operation which deteriorate quality of air. The dust affects negatively the health and the pleasure of residents. The effect becomes stronger as the drier of weather, heavier of wind and increment of silt and sand together with the extracted material. The dust effect is still worse near the open quarries where rock aggregate is extracted by crushing. Dust from aggregate production is fine and needle-sharp and dust from crushed rock seems to be common cold and when breathing unhealthy.



**Fig. 5. Social impacts of Artisanal mining**

Slope failure in working operation also increase the risk of rock fall which damage the surrounding properties and cause injury to human life. The noise level rise and fall throughout the work day as activity ebbs and flows. The human ear has an extremely large range of response to air pressure variations which in case of sound are represented air pressure waves that cause the eardrum to vibrate. Hence the artisanal mining operation has more than these noise levels which can lead to extreme effect to happen. Generally, mining activities near village damage of property, fracturing of the building like bridge, house or any man-made structure in the surrounding area. During working time local workers do not wear clothes and other personal protective material that may protect them from harm which may be due to increment of temperature. Generally, Gold miners extracted massive soil materials that removed substantial volumes of soil. Abandoned gold pits were exposed to soil piping's, and became hotspots of soil erosion. In these micro-environments, higher quantities of soil were lost in the mining sites as compared to adjacent unmined sites. With temporal scale, these soil structures collapsed due to active water seepage and leaks during the summer. Analogous to this finding, Adeoye (2015) and Hilson and Van Der Vorst

(2002) reported that soil piping was widespread after the abandonment of artisanal gold mining. As known that soil and rock pitting for gold mining was a dominant driver for fertile soil loss. In this regard, the gold mining system exacerbated rates of soil erosion forms mainly sheet, rill, and gully erosion. Artisanal gold mining contributed to the present magnitude of gully erosion that threatened soil resources. Similarly, the study area indicates that artisanal gold mining severely reduced agricultural land productivity. Indeed, these studies report that vast tracts of croplands were changed into wastelands. Consequently, uncontrolled gold mining practices reduced the supply of environmental services to the farmers who depend on land resources. The status of woody vegetation across mined and unmined areas was vastly contrasting and affected the woody vegetation. The density and the number of woody vegetation in mined sites were different from the density of woody vegetation in unmined sites. This shows that density of a tree in unmined sites was higher than in the mined sites. Furthermore, artisanal gold mining destroyed biodiversity and their ecosystem services. This, in turn, shrunk the livelihood strategies of the poor farmers located at the gold mining sites. Artisanal mining operations could result in more long-term effects on the sustainable livelihoods of the local community. As a response to the mounting impacts of artisanal mining, various forms of intervention are required to mitigate the negative impacts of gold mining in the study area. Agricultural development agents require better environmental knowledge to mitigate the devastating impacts of artisanal gold mining on the sustainability of land resources.

## CONCLUSION

Artisanal mining (especially gold) is a widespread activity in Southern Africa due to recurrent droughts and economic hardships within the region. It contributes positively to the socio-economic being of many African countries but has also contributed to the deterioration of environmental quality. Artisanal and small-scale mining activities or operations lack capital, are labor intensive, have poor access to markets and support services, low standards of health and safety and have a significant impact on the environment. The study showed that artisanal mining sites were hotspots of soil erosion in the study area. Soil erosion from artisanal mining was enormous. Gold pitting caused artisanal gold mining and land resources by a hydrogeomorphic process accelerated the magnitude of sheet, rill and gully development. A higher volume of soil was lost at the gold mining sites than at adjacent unmined sites. The current study set out to establish the major environmental damages caused by gold panning in Kape area. This study justified to expose the impacts caused by traditional gold panning activities in Kape, with a view to provide good information for the effective supervision of the environmental management in the region. The mining activity used to extract the industrial minerals and rocks in the area is surface mining particularly quarrying & dredging, which are included as surface mining methods. Quarrying is a type of surface mining from which rocks or minerals are extracted where little size rocks are made from big rocks. Dredge mining is excavation of underwater mineral resources by floating equipment. This mining activity is carried out by local residents in the study area using different simple material equipment. Artisanal mining operation has adverse effect on the environment: biosphere, lithosphere, hydrosphere and the adjacent resident.

The impact on the environment is due to land clearing and improper excavation. At the time of rehabilitation plantation of the area mostly depends on indigenous species because indigenous species has the capacity to tolerate a destroyed environment. Generally, the abandoned mine working area should be rehabilitated to create a clean and health environment for urban local residents and the region. Therefore, the government and its partners should make efforts to harmonize forestry and mining laws to avoid conflicts of interest which lead to sustainable management of both forest and mineral resources etc.

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