Mining Effects On Forest Area of Mussoorie Division
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Abstract— Mining is the extraction of valuable minerals or other geological materials from the earth from an ore-body, lode, vein, seam or reef, which forms the mineralized package of economic interest to the miner. The mining industry in India is a major economic activity which contributes significantly to the economy of India. The GDP contribution of the mining industry varies from 2.2% to 2.5% only but going by the GDP of the total industrial sector it contributes around 10% to 11%. Even mining done on small scale contributes 6% to the entire cost of mineral production. Indian mining industry provides job opportunities to around 700,000 individuals. India’s minerals range from both metallic and non-metallic types. The metallic minerals comprise ferrous and non-ferrous minerals, while the non-metallic minerals comprise of mineral fuels, precious stones, among others. Mining is a process through which we can utilise natural resources in the form of copper, flour, steel, jewellery, coal etc. all these we use in our daily life for different purposes. The nature of mining processes creates a potential negative impact on the environment both during the mining operations and for the years after the mine is closed. Due to unsystematic way of mining and to access large amount of benefits causes negative impact on environment. Negative impact may leads to deforestation, landslides, sinking of water table, earthquakes, etc. In this paper there is summarization of mining, types of mining, major problems caused in area due to mining and their negative influence in Mussoorie Division and how we can reduce the negative effects of mining.

Keywords: GDP, deforestation, landslides, ore-body, lode, vein

I. INTRODUCTION
Mining in a wider sense comprises extraction of any non-renewable resource (e.g. petroleum, natural gas, or even water). Mining of stone and metal has been done since pre-historic times. Modern mining processes involve prospecting for ore bodies, analysis of the profit potential of a proposed mine, extraction of the desired materials and finally reclamation of the land to prepare it for other uses once the mine is closed. The nature of mining processes creates a potential negative impact on the environment both during the mining operations and for years after the mine is closed. This impact has led to most of the world’s nations adopting regulations to moderate the negative effects of mining operations. Safety has long been a concern as well, though modern practices have improved safety in mines significantly. Mining is a very profitable business and it also creates employment opportunities. It benefits everyone including the government and that is why the mining industry is widely supported. There are several negative effects of mining for the environment. To make mining possible, several forests are cleared and this leads to deforestation. The vegetation is cleared in order to build the mining facility and laying roads. Several organisms and animals live in these forests. With the deforestation, these organisms and animals lose their natural habitat. So, they were looking for a new habitat in order to survive. However, most organisms and animals do not respond very well and end up dying. The biodiversity is lost this process. The numbers of smaller plants and creepers that grow with the support of the tress also die due to deforestation. Every single forest in the world is a biosphere of its own. It is impossible to create a biosphere artificially as the various processes and inter-dependence of organisms is too complicated.

In addition, mining causes a lot of pollution as a lot of chemical waste incurred due to the various processed involved. This waste is released into water bodies, rivers and sea. The chemical composition of the soil also changes in the mining area. It becomes a desert-like environment where nothing grows.

A. Mining Types
Impact of mining on land, due to excavation depends upon the type of mining. Broadly there can be two types of mining depending upon the depth of the deposit to be mined, namely surface (OC) mining and underground mining (UG). Examples of OC mining are the Kudremukh iron mines in Western ghat region of Karnataka, Noamundi iron mines in Bihar, Jhamarkotra phosphorite mine in Udaipur, Rajasthan coal quarries and Raniganj and Jharia coal fields etc. There may be broadly two types of OC mining depending up on terrain conditions, these are ‘Area strip mining’ and ‘contour strip mining’. Contour strip mining refers to the method applied on rather flatish terrains. Further, UG mining can be of different types depending upon the characteristics of the deposit specially its mode of occurrence. Each of the varieties of mining are hence being considered separately.

1) Area Strip Mining
In outline, the method involves stripping away the overburden and to recover the mineables by use of bulldozers, scrapers or by manual operations. This obviously forms great scars on land at the site of excavation and large piles of overburden material (OB) where the waste is dumped. This results land degradation and land pollution at the excavation site and also at the dumping site.

OC mining needs excavation of land surface. It obviously degrades the quality of excavated land as it gets lowered from its original topographic height. Soil profile in the region gets disturbed and hence the soil quality, its chemical and physical character, behaviour with water, none remains as it was in original condition, because a huge mass of land is excavated out from its orginal site and placed at a new place. The quarries generated by excavation if left unreclaimed, that amount of land become useless.

The nature of degradation varies with depth of excavation. There may be cases of OC mining which create only shallow depressions on land but no OB. Examples of these are mainly stone quarries and clay scrapping for brick-kilns. Impact of these on land are mostly ignored because of shallowness of the quarries; while the fact is, these disturb the topography sufficiently to disturb the surface water flow...
pattern i.e. the surface water potentialities of the region. Clay-scrapping specially causes loss of topsoil and hence greenery growing potentialities of the region.

If the depth of excavation is such that it damages the upper part of the aquifer underground, water flows into the excavation site continuously from the remaining part of the aquifer. Continuous pumping of water from the site facilitates mining. Land degradation due to this has been detailed in section. In some other cases where the quarry is deep enough to excavate out the total aquifer in the region, its consequences may create damage to water table regional lowering of water table and hence drying-up of land and land degradation. These excavations of aquifers generate a persistent problem. Even when the quarry is black-filled in the name of physical reclamation, it is filled with a material too loose to represent the impermeable layer that was existing at the base of the aquifer. Thus the aquifer is never regenerated. This creates a situation which goes against sustainable greenery growth over the mining degraded land, even after so-called biological reclamation.

2) Contour Strip Mining
Such mining exposes fresh surfaces on sloping land and hence makes these highly prone to rain wash, weathering and erosion, which results silitation in the surrounding area’s land and water system. Such weathering and erosion may even cause water pollution and hence chances of land degradation. Further, if among the minerals there is involvement of pyrite, marcasite, ankerite, and siderite etc. results in production of sulphuric acid and other soluble salts such as sulphates and oxides causing flora, fauna loss. The sulphates and oxides also damage the chemical characteristics of the land.

3) Underground Mining
Excavation for UG mining does not create any direct impact on land other than making dumps of materials excavated for reaching the deposit, and the materials excavated with the deposit as gangue mineral. The matter of subsidence is being dealt separately.

There may be different types of UG mining depending upon mode of occurrence of the material to be exploited:

(1) If it is bedded deposit, it is approached by shaft or inclined as the case may be and then only the deposit mining.

(2) If it is vein deposit it is to be approached almost similarly but at same time of exploitation the total vein is to be excavated out which requires, in some cases (e.g. quartz-mica veins, gold-quartz veins etc.) excavating some unwanted (gangue) minerals together with the desired ones (ores).

(3) If the desired material occurs in disseminated pore-spaces of the country rock (e.g., water etc.) the mineral is to be gained mainly through drilling or pumping (as the case may be), it creates minimum land degradation through excavation other than damage by drilling and ancillary activities. However, long continuation of such action may result subsidence.

Deeper OC excavation on land or UG digging causes damage to aquifer and the water table to sink locally, often drastically, resulting in the drying up of wells and springs of the neighborhood; at least the perennial ones may be affected to seasonal. In case of contour strip mining, subsequent landslides may expose passages of UG water, thus depriving the springs which were being supplied from the source. Some such situation has deprived the Sahasradhara seepage of Mussoorie hills, altering land quality of the region.

II. LOCATION AND CLIMATE
Mussoorie mountain resort is situated at the top of 2000 meters high ridge facing the plains of western Uttar Pradesh. It experiences marginally higher temperatures as compared to the other mountain resorts of the western Himalaya. Snowfalls may occur occasionally during the winter season. Rains are very heavy with the town remaining under a thick blanket of mist for days together. Southern part of Mussoorie Hills is in between N 30° 23’ to N 30° 27’ and E 78° 07’ to 78° 02’.

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<th>Total area (in hectares)</th>
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Table 1: Aglarh micro-watersheds (catchment) and geographical location of mining

Mussoorie is a hill station and a municipal board in Dehradun District of the northern Indian state of Uttarakhand. It is located about 35km from the state capital of Dehradun and 290km north from the national capital of New Delhi. This hill station, situated in the foothills of the Grahwal Himalyan ranges, is also known as the Queen of the Hills. The adjoining town of Landour, which includes a military cantonment, is considered part of "greater Mussoorie", as are the townships of Barlowganj and Jharipani.

III. GEOGRAPHY
Being at an average altitude of 1,880 meters (6,710ft), Mussoorie, with its green hills and varied flora and fauna is a fascinating hill resort. Commanding snow ranges to the north-east, and glittering views of the Doon valley and Siwalik ranges in the south, the town was said to present a ‘fairyland’ atmosphere to tourists. The highest point is Lal Tibba with a height of over 2,290 meters (7,510ft).

IV. BRIEF HISTORY
The name of ‘Mussoorie’ is said to be derived from the term ‘mansoor’, a shrub found abundantly in the area. Earlier, only raod transport was available as an accessible to
Mussoorie. The travellers had to travel as road distance of 93 km from Saharanpur to reach Mussoorie but with railway reaching Dehradun in 1990, the accessibility to the place became easier with a road travel of just 34 kms.

The low line area of Himalayan mountain range especially Dhunghati is famous for high quality limestone. Lime stone is not only use for making lime but also for sugar, steel, cement and chemical industries. According to the data of 1888 there were 36 lime furnaces in Dhunghati. Limestone was collected from the river bed for the collection of lime. Sixteen thousand tones of lime is exported yearly round off. In 1900 due to Dehradun railway track connectivity, resulted in excessively extraction of limestone. The mountains were exploiting in an erratic manner. Along with limestone, rock phosphate and white marbles are also exploited. In 60s century there was large increment in mining furnaces, after being opposed by many forest division and other organizations in that period, even though several mining furnace were authorized. Using of explosives in an unsystematic manner disturbed the Nature’s equilibrium. In 1980 the people who are aware of disturbance caused through mining got success in closing of many furnace by High court through the Centre of rural Legislation and Entitlement. Through this awareness of people many furnace was closed. And in the year 1983 to the year 1985 several furnaces were closed. In 1980 there were 101 furnaces in or near Dhunghati.

V. MAJOR PROBLEMS CAUSED IN AREA DUE TO MINING
A. Mined Face
Steep, exposed, rocky and devoid of soil and vegetation.

B. Scree Areas
Formed as a result of rolling scree from the mined area, completely destroying the vegetation below.

C. Nalas Channels and Streams
Small or big streams/nalas in and around the mined area which were over burdened with scree damaged by mining operation and were extremely sensitive to erosion.

D. Denuded And Degraded Forest Areas
These areas were near to mined areas and affected by mining operation.

VI. DISADVANTAGES OF MINING
A. Loss of Productive Topsoil
Nature takes thousands of years to produce a few centimetres of topsoil, which is the base for the growth of all types of vegetation. When the overburden is removed in mining, this valuable topsoil is lost within a few hours.

B. Loss of Valuable Land
Quarrying or open cast mining means a diversion of valuable land. This land could have very easily been put to use under agriculture, Forestry or as a pasture. Thus, for all practical purposes, this land is lost forever so far as its use in agriculture is concerned. Reclamation techniques are yet to be adopted in the Himalaya.

C. Wildlife
The forests are the home of a large variety of wild animals. The cutting down of vegetative growth disturbs their habitat and they are forced to move other areas. Blasting and the sound of heavy machinery disrupt the wildlife residing in that area.

D. Hydrological Problems And Pollution
Loss of valuable topsoil and vegetation means little or no infiltration of water into the soil. This leads to a fall in the level of the local water table. Devoid of the protective cover of the topsoil, the exposed rock are subjected to the full action of the falling rain water. Some of the chemicals present in the rocks e.g., calcium, may be dissolved by the rain water, thus making it dangerous for human consumption, agricultural purposes or industrial uses. When this water containing dissolved chemicals reaches bigger streams and rivers, it may pollute them, thus affecting aquatic life. The runoff from the limestone quarries from Mussoorie contains large quantities of calcium carbonate.

E. Loss of Vegetation
In mining there is removal of valuable forests, which result in an immense loss that cannot be recovered.

F. Artificial Undercutting Of Unstable Sides
Undercutting of slopes prone to sliding, changes the force ratio acting on the slope to the advantage of active force. Negative influences, after slope undercutting, are also manifested by worsening the rock properties in the cut and by the acceleration of erosion processes (Figure 1). The deterioration of the properties of the rock forming the slope appears by loosening of the slope and swelling of rocks little resistant against weathering. The rock freeze and weather more quickly. In special cases when realizing cuts below the groundwater table their stability may also be decreased by the occurrence of suffusion phenomena.

Deterioration of Proper rock

Acceleration of

Reduction of passive forces

Fig.1: Negative influences of undercutting of slopes

G. Air Pollution
A large quantity of dust is released to the quarry site itself. It may consist of pure calcium carbonate powder (in limestone quarries), silica dust (in quartzite quarries) and clayey dust (in slate quarries). This dust has an adverse impact on the health of the laborers involved in the extraction process. Very often, the road constructed for transporting the quarried material is extremely dusty. Whenever a vehicle passes a huge quantity of dust is blown high into the air. In the process of converting limestone into a more usable form (slaking) a large amount of carbon dioxide is released into the atmosphere, which is injurious to health. At times, strong winds tend to spread this smog over a large area.

In seventies when limestone quarries in Mussoorie were producing a large quantity of limestone, much of the slaking was done in the furnaces dotted all over Dehradun. The skies over this idyllic valley were filled with the smog...
produced by the furnaces. Several cases of pneumoconiosis were reported from this region during the period. Other diseases caused by air-pollution related to quarrying are silicosis (in quartzite quarries) and asbestosis (in asbestos mines).

H. Dynamic Vibrations
Dynamic vibrations of anthropogeneous origin (heavy transport, detonation works) may initiate in water saturated soils a critical water pressure in the pores and soils on the slope may liquefy. Dynamic vibrations as horizontally acting forces on the particles of rock forming the slope bring in further negatively acting factors to the stability scheme. The particles are strained tangentially by the acting forces and friction is decreased on the shear surface (Figure 2).

![Diagram](image)

**Fig. 2: Influences of Dynamic Vibrations**

I. Mineral Transport
Roads have to be constructed right up to the quarry so that the mineral can be readily extracted. This causes damage to the vegetation and soil and results in numerous debris slides. It also affects the local drainage, agriculture and quality of the water that is available for human and animal consumption. In many cases, these roads are constructed in contravention of the established principles of engineering. In the Hills, heavy rains during the monsoon season may cause landslides in these roads. This results in widespread havoc and it is a constant threat to life and property.

J. Sediment Inflow
Mining results in the release of a vast quantity of sediment into the surface runoff. The base rocks are highly susceptible to the erosive action of the falling rain drops. Blasting weakens the country rock and renders them more prone to the scouring action of the surface runoff. The erosive capacity of the sediment bearing surface runoff is immediately increased and it leads to the formation of rills and gullies in the fields lying below the quarries.

The runoff may deposit this unsorted sediment on forest land, agricultural land, roads and it may choke canals and stream, channels thus causing Floods. Moreover, water with high sediment content is unfit for human consumption and for irrigation as it causes harm to the crop.

K. Blasting
Dynamite is used to weaken the host rock so that they can be easily extracted by hand tools or bulldozers. Blasting produces shock waves which weaken the country rock. The rate of detonation of standard dynamite is 3000m/sec. Detonation are special types of shock waves. They are elastic waves of large amplitude with a steep front which travel faster than acoustic waves. These shock waves have a constant amplitude and velocity. In some explosives, pressure of about 1,000,000kg/sq centimeters and a temperature of up to 3000° C are produced. These shock waves may activate geological faults, lead to slope failure and weaken the country rocks, thus making them more susceptible to accelerated erosion.

L. Debris
The debris released during excavation operations is rolled down the hill slopes. This debris may cover valuable arable land, forest pastures, roads, canals and even human settlements.

VII. DEFORESTATION
Mining needs clearing the acquired land which in most cases need deforestation, which invites land degradation. Among the odd activities required for mining, the most prominent, effective, inevitable activity is deforestation while its long-term effects, i.e. land degradation and desertification are indirect, and hence, to some extent intangible, but these produce most serious effect. With the realization of an ever increasing pressure on forests, loss of biodiversity due to changes in land use/land cover and impact of forest own climate changes, monitoring of forest cover has been appreciated more than ever before all over the world. The definition of forest varies across countries. FAO Global Forest Research Assessment 2005 has used parameters of minimum tree height 5.0 meter, canopy cover more than 10% and minimum land area 0.5 ha. The threshold of 10% is key in this definition. In many countries, forest is typically defined has an area with substantially higher levels of canopy closure, for example, 30-40% depending on age in Russia, and 60% in South Africa, in Australia, forest is defined as a vegetation type of dominated woody species having a mature height exceeding 5.0 meter, with an over storey canopy cover greater than 20%. In the classification of forests introduced by UNEP WCMC; all forest classes have a minimum threshold of 30%, except for the class including sparse and woodland, for which canopy closure in the form 10% to 30%. Forest cover analysis by Forest Survey Of India (FSI) using satellite data, defined forest as an area of more than 1 ha and >10% of tree canopy cover. The scale of current manmade destruction is the prime concern of the day, has it leads to deforestation which has been ranked as the greatest global environmental problem. Deforestation can be defined as the process of change of land use with depletion of tree crown cover less than 10%. The effects of deforestation on biodiversity are mainly destruction of habitat, fragmentation and creating edge effects between the boundary of a forest and deforested land. Deforestation in India is of particular concern because of the sub-continent spectacular wildlife, unique flora, and high concentration of wild relative of domesticated plants and animals. Moreover, the sustained productivity of India’s agricultural, plantation of perennial crops, the forest sector is depend upon forests that conserves soil, nutrients, water and genetic resources. India’s forests also directly support 50 million people that rely on forest ecosystem for their subsistence. However, consistent estimate of deforestation rates in India are lacking.

VIII. DISCUSSION
Mining engineers are in charge of planning, designing, organizing and supervising the development of mines and much of the related facilities, equipment and infrastructure. They are hired by mining companies to prepare for the extraction of minerals, coal or metals from underground or
open-pit mines. They work for mining companies, manufacturers, government and in education. Mining engineering includes facets of geological, civil, mechanical and materials engineering. Mining engineers conduct initial surveys of the deposits in a potential area for mining to determine the economic and environmental benefits and costs of starting an operation. They prepare operations and estimate the cost and length of a project. They then decide on how to safely and efficiently extract goods from viable mines. Mining engineers are involved in every step of development, from determining the best method of drilling and blasting to start a mine and then creating the shafts, ventilation systems, mine services, haulage mechanisms and other supporting structure to allow miners to safely work.

Once a mine is up and running, mining engineers supervise further development and ongoing maintenance of existing areas. They also supervise survey personnel, other engineers, scientists and technicians working on the site. They often work with geological engineers, metallurgical engineers and other engineers, and it is possible to move from one specialty to another.

IX. CONCLUSIONS

Local people, including farmers, landless laborers, women, rural artisans and cattle rarer, are the custodians of traditional knowledge. Moreover, these people are well informed about their own situations, their resources; what works and doesn’t work; and how one change impacts other parts of their system. It should not be forgotten that Indigenous knowledge is a very sensitive issue, related with cultural identity and ethnicity. It reflects the dignity of the local community and puts its member on equal footing with the outsiders involved in the process of technology development (Havekort and Zeeuw, 1989). Truly the Article 8(J) of the Convention of Biological Diversity (Rio, 1992) has indicated the importance the noble deed of ‘respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional life-styles relevant for the conservation and sustainable use of biological diversity’.

Coal mining in India also needs technology improvements, which will reduce the ash content of coal and improve power plant performance. This is underway in public sector mining companies. Mining leases have also been given to many private companies in the last few years which are expected to be efficient.

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