Chapter I
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1.1 Introduction

Worldwide consumption of mined commodities has increased steadily in recent years, a trend that is expected to continue, as a result of strong demand in fast growing developing countries. At the same time, the extraction and processing of minerals imposes environmental and social costs. Several factors contribute to the environmental and social impacts of mining. With regards to the extraction of industrial minerals and metals, the first one is the “size” of mining as an economic activity, which relates to the demand for minerals and metals as inputs in the production system. The second one is the environmental impacts of specific extraction techniques, and more broadly the way extractive projects are managed on the ground.

The growth of mining industry significantly contributes towards economic progress of the country. Mining is viewed as one of the important economic activities which have the potential of contributing to the development of economies. Mining and power generation are among the most important developmental activities after agriculture. Mining activities are known to release significant amounts of toxic metals into the surrounding environment [1]. This rapid expansion of the mining industry has significant environmental, social and economic impacts on local communities in the region where mining is conducted. The environmental deterioration caused by mining occurs mainly as a result of inappropriate and wasteful working practices and rehabilitation measures. Mining has a number of common stages or activities, each of which has potentially-adverse impacts on the natural environment, society and cultural heritage, the health and safety of mine workers, and communities based in close proximity to operations [2,3]. In mining areas, the impact of mining activities
on the surrounding region is controlled by the regional climate (arid or humid), mining methods (open cast or underground), geological conditions (slope, topography, and faults), and present condition of the mine (active or abandoned) [4] (Bell et al. 2001). The tailings left over by past mining activities are disposed into the surrounding soils leading to environmental pollution as the metals present in these areas effects the soil and aquatic environments. This is mainly due to the presence of metal sulfides and its subsequent leaching products due to changes in local environmental conditions [5-9] (Salomons 1995; Passariello et al. 2002; Mian and Yanful 2003; Lee et al. 2005; El-Khalil et al. 2008). The Large amounts of waste rock and tailings contaminated with toxic metals are produced during mining.

While there have been improvements to mining practices in recent years, significant environmental risks remain. The peak period of metal mining started during the mid to late nineteenth century, during this period the waste generated were discharged from many mine sites to near by areas. In such catchments, as much as 90 percent of the metals were associated with sediment rather than in aqueous forms, and metal contaminants are primarily mobilized and transported to downstream, and deposited, by river processes. This has created a legacy of highly contaminated sediments, often a considerable distance (tens of kilometers) downstream from the mines themselves. There is a concern that these sediments may be causing damage to aquatic ecosystems (such as benthic organisms, fish, plants) in rivers. In addition, they may pose a risk to agricultural and other uses of floodplains as a result of the mobilization of contaminated sediments during floods, which cause the heavy metal sediments to be deposited on the floodplain. Negative impacts can vary from the sedimentation caused by poorly built roads during exploration through to the sediment, and disturbance of water during mine construction. The erosion, transport
and deposition of historically contaminated alluvium are a very important source of sediment borne metals in all mining affected river systems [10] (Macklin, 1992).

The environmental and health impacts of mining on surrounding communities have been a major concern to governments, the general public and stakeholder organizations and individuals. In addition to the occupational health effects of working in mines, people who live close to mining areas may suffer the environmental health effects of degradation associated with land use change from mining and infrastructure development; top soil removal; overburden dumping; acid mine drainage; the degradation of surface and ground water quality; and increases in temperature and air pollution. Moreover, people who live close to mining areas are likely to consume drinking water from surface and groundwater sources contaminated by chemical wastes and debris from mining activities [11](Winkel, Berg, Amini, Hug, & Johnson, 2008). Other major pollutants from mining activities are particulate matter, dust and noise. People who live close to mining areas commonly suffer respiratory illnesses and hearing problems [12] (IDRC, 2006). On the other hand, mining can have beneficial local impacts in terms of economic expansion and decreasing poverty. It creates employment and attracts investment. Mining jobs and the additional employment from increased infrastructure benefit local and regional communities. Especially where there is significant under-employment, new jobs in the mining sector increase income, which in turn improves qualities of life. Income is well known to be correlated with health status. This is logical because income affects every aspect of living, from where people live to what people eat. People with higher income tend to enjoy better standards of living, health and access to better health care.
1.2 History of Mining

Mining may well have been the second of humankind’s earliest endeavors granted that agriculture was the first. The two industries ranked together as the primary or basic industries of early civilization. Little has changed in the importance of these industries since the beginning of civilization. If we consider fishing and lumbering as part of agriculture and oil and gas production as part of mining, then agriculture and mining continue to supply all the basic resources used by modern civilization. From prehistoric times to the present, mining has played an important part in human existence [14] (Madigan, 1981). Here the term mining is used in its broadest context as encompassing the extraction of any naturally occurring mineral substances solid, liquid, and gas from the earth or other heavenly bodies for utilitarian purposes.

The history of mining is fascinating. It parallels the history of civilization, with many important cultural eras associated with and identified by various minerals or their derivatives: the Stone Age (prior to 4000 BCE), the Bronze Age (4000 to 5000 BCE), the Iron Age (1500 BCE to 1780 CE), the Steel Age (1780 to 1945), and the Nuclear Age (1945 to the present). Many milestones in human history Marco Polo’s journey to China, Vasco de Gama’s voyages to Africa and India, Columbus’s discovery of the New World, and the modern gold rushes that led to the settlement of California, Alaska, South Africa, Australia, and the Canadian Klondike were achieved with minerals providing a major incentive [15](Rickard,1932). Other interesting aspects of mining and metallurgical history can be found by referring to the historical record provided by [16, 17] Gregory (1980), Raymond (1984). The abundance of minerals also provides a method of creating wealth. Minerals can be marketed on the open market, enabling the countries that possess them to obtain valuable currency from countries that do not. This generally results in the minerals-rich countries being
the great civilizations of the world while the ‘have-not’ countries generally suffer from a lower standard of living. The ability to use mineral resources as a means of creating wealth opens the possibility that a given country or countries will attempt to control the entire market in a particular mineral, that is, to create an economic cartel in that mineral.

Mining in its simplest form began with Paleolithic humans some 450,000 years ago, evidenced by the flint implements that have been found with the bones of early humans from the Old Stone Age [18](Lewis and Clark, 1964). Our ancestors extracted pieces from loose masses of flint or from easily accessed outcrops and, using crude methods of chipping the flint, shaped them into tools and weapons. By the New Stone Age, humans had progressed to underground mining in systematic openings 2 to 3 ft (0.6 to 0.9m) in height and more than 30 ft (9m) in depth [19](Stoces,1954). However, the oldest known underground mine, a hematite mine at Bomvu Ridge, Swaziland (Gregory,1980),is from the Old Stone Age and believed to be about 40,000 years old. Early miners employed crude methods of ground control, ventilation, haulage, hoisting, lighting, and rock breakage. Nonetheless, mines attained depths of 800 ft (250m) by early Egyptian times.

Metallic minerals also attracted the attention of prehistoric humans. Initially, metals were used in their native form, probably obtained by washing river gravel in placer deposits. With the advent of the Bronze and Iron Ages, however, humans discovered smelting and learned to reduce ores into pure metals or alloys, which greatly improved their ability to use these metals. The first challenge for early miners was to break the ore and loosen it from the surrounding rock mass. Often, their crude tools made of bone, wood, and stone were no match for the harder rock, unless the rock contained crevices or cracks that could be opened by wedging or prying. As a
result, they soon devised a revolutionary technique called fire setting, whereby they first heated the rock to expand it and then doused it with cold water to contract and break it. This was one of the first great advances in the science of rock breakage and had a greater impact than any other discovery until dynamite was invented by Alfred Nobel in 1867. Mining technology, like that of all industry, languished during the Dark Ages. Notably, a political development in 1185 improved the standing of mining and the status of miners, when the bishop of Trent granted a charter to miners in his domain. It gave miners legal as well as social rights, including the right to stake mineral claims. A milestone in the history of mining, the edict has had long-term consequences that persist to this day. The greatest impact on the need for and use of minerals, however, was provided by the Industrial Revolution at the close of the eighteenth century. Along with the soaring demand for minerals came spectacular improvements in mining technology, especially in scientific concepts and mechanization that have continued to this day.

During the last two centuries, there has been great progress in mining technology in many different areas. Such progress is often made in an evolutionary rather than a revolutionary manner. Yet every once in a while, a revolutionary discovery comes along and changes the process of mining profoundly. During the nineteenth century, the invention of dynamite was the most important advance. In the twentieth century, the invention of continuous mining equipment, which extracts the softer minerals like coal without the use of explosives, was perhaps the most notable of these accomplishments. The first continuous miner was tested in about 1940, with its usefulness greatly enhanced by the development of tungsten carbide inserts in 1945 by McKenna Metals Company (now Kennametal). By 1950 the continuous miner had
started to replace other coal mining methods. The era of mechanized mining had begun.

1.3 What is mining?

The essence of mining in extracting mineral wealth from the earth is to drive an excavation or excavations from the surface to the mineral deposit. Normally, these openings into the earth are meant to allow personnel to enter into the underground deposit. However, boreholes are at times used to extract the mineral values from the earth. These fields of boreholes are also called mines, as they are the means to mine a mineral deposit, even if no one enters into the geologic realm of the deposit. Note that when the economic profitability of a mineral deposit has been established with some confidence, \textit{ore or ore deposit} is preferred as the descriptive term for the mineral occurrence. However, coal and industrial mineral deposits are often not so designated, even if their profitability has been firmly established. If the excavation used for mining is entirely open or operated from the surface, it is termed a \textit{surface mine}. If the excavation consists of openings for human entry below the earth’s surface, it is called an \textit{underground mine}. The details of the procedure, layout, and equipment used in the mine distinguish the \textit{mining method}. This is determined by the geologic, physical, environmental, economic, and legal circumstances that pertain to the ore deposit being mined. Some general terms are best defined at the outset; these are outlined here.

\textit{Mine}: an excavation made in the earth to extract minerals

\textit{Mining}: the activity, occupation, and industry concerned with the extraction of minerals
**Mining engineering**: the practice of applying engineering principles to the development, planning, operation, closure, and reclamation of mines

Some terms distinguish various types of mined minerals. Geologically, one can distinguish the following mineral categories:

**Mineral**: a naturally occurring inorganic element or compound having an orderly internal structure and a characteristic chemical composition, crystal form, and physical properties

**Rock**: any naturally formed aggregate of one or more types of mineral particles

Economic differences in the nature of mineral deposits is evident in the following terms:

**Ore**: a mineral deposit that has sufficient utility and value to be mined at a profit.

**Gangue**: the valueless mineral particles within an ore deposit that must be discarded.

**Waste**: the material associated with an ore deposit that must be mined to get at the ore and must then be discarded. Gangue is a particular type of waste.

A further subdivision of the types of minerals mined by humankind is also common. These terms are often used in the industry to differentiate between the fuels, metals, and nonmetallic minerals. The following are the most common terms used in this differentiation:

**Metallic ores**: those ores of the ferrous metals (iron, manganese, molybdenum, and tungsten), the base metals (copper, lead, zinc, and tin), the precious metals (gold, silver, the platinum group metals), and the radioactive minerals (uranium, thorium, and radium).
Nonmetallic minerals (also known as industrial minerals): the nonfuel mineral ores that is not associated with the production of metals. These include phosphate, potash, halite, torn, sand, gravel, limestone, sulfur, and many others.

Fossil fuels (also known as mineral fuels): the organic mineral substances that can be utilized as fuels, such as coal, petroleum, natural gas, coal bed methane, Gilsonite, and tar sands.

1.4 Importance of mining

Beyond employment and other direct economic impacts of mining operations, creating linkages between mining and the rest of the economies is critical for development. Without an integrated approach, there are real risks that mining operations operate as enclaves, with few spillovers to the rest of the economy. An approach used in Mozambique, Liberia and other countries is that of growth routs or development routs, where planned mining development are integrated within broader spatial planning that aims to develop locally suited economic activities (such as agriculture, forestry, small scale mining) by taking full advantage of the infrastructure created specifically for the needs of mining projects. For example, roads, railway lines, electricity generation facilities, and port facilities can be built with additional capacity to allow other activities to use them or communities to benefit from them.

Depending on a country’s priorities and economy, the following strategies may be effective, alone or in combination with one another: investments in education and infrastructure to increase the long term competitiveness of the manufacturing sector; isolate a part of the revenues from mining from the rest of the economy, and use them for investment abroad; set aside some part of the revenues for future generations. Revenues from minerals (or the windfall part of them) can also provide reserves that can be used in counter cyclical ways to limit the impacts of external shocks on
national economies. Experts agree that in many countries, the compensations to host communities are insufficient to address local depletion of environmental assets and other social impacts of projects. In order to make a difference to development outcomes, revenues from natural resources need to be able to generate additional and sustainable incomes, beginning with replacing income sources or opportunities that have been destroyed by the mining activities such as farming and fishing. Projects which create links between mineral extraction and the local economy are very important in that context.

1.5 Social and Economical Impacts of mining

The social impacts of large-scale mining projects are controversial and complex. Mineral development can create wealth, but it can also cause considerable disruption. Mining projects may create jobs, roads, schools, and increase the demands of goods and services in remote and impoverished areas, but the benefits and costs may be unevenly shared. Magnitude of these changes leads to a large extent on the existing environmental conditions and socioeconomic status of the people. Apart from pollution of the natural environment mining also leads to impacts on health, alteration of social relationships, destruction of forms of community subsistence and life, social disintegration, changes in regional cultures and displacement of other economical activities. Mining has a number of common stages or activities, each of which has potentially-adverse impacts on the natural environment, society and cultural heritage, the health and safety of mine workers, and communities based in close proximity to operations. Most large-scale mining projects have duration of 10 to 40 years, after which the mining companies gets closed. Any industries established by these companies like educational, clinical, and other services lose their funding. One of the most significant impacts of mining activity is the migration of people into a mine
area, particularly in remote parts of developing countries where the mine represents the single most important economic activity. Hazardous substances and wastes in water, air, and soil generated by mining can have serious, negative impacts on public health. When mining activities are not adequately managed, the cost of the contamination is transferred to other economic activities, such as agriculture and fishing. Mining activities can suddenly affect quality of life and the physical, mental, and social well-being of local communities. Improvised mining towns and camps often threaten food availability and safety, increasing the risk of malnourishment. Indirect effects of mining on public health can include increased incidence of tuberculosis, asthma, chronic bronchitis, and gastrointestinal diseases.

1.6 Environmental impacts of mining

Mining operations may have a range of environmental impacts, including land degradation, water pollution, air pollution and destruction of natural habitat. While some impacts are unavoidable once mining operations begin. Any deterioration in the physical, chemical, and biological quality of the environment affects human health and flora and fauna. The health problem of miners arising out of on-site pollution due to dust, gases, noise, polluted water, etc. is receiving increasing attention. The magnitude and significance of impact on environment due to mining varies from mineral to mineral and also on the potential of the surrounding environment to absorb the negative effects of mining, geographical disposition of mineral deposits and size of mining operations.

Water in mining is essential in all mining categories, ranging from hard rock, sand and gravels mining, to industrial mineral mining and coal mining [13]. A major environmental problem relating to mining in many parts of the world is uncontrolled discharge of contaminated water from abandoned mines. The acid mine drainage
(AMD) is not only associated with surface and groundwater pollution, but is also responsible for the degradation of soil quality, aquatic habitats and for allowing heavy metals to seep into the environment. Cyanide, which is acutely toxic to humans, is used by in the mining industry to extract gold and silver from ore. The disposal of tailings from mining has been a pervasive cause of environmental damages. Riverine tailings disposal has been criticized as destroying ecosystems and polluting water sources. Accumulation of tailings and red mud will add to the seriousness of the environmental adverse effects.

1.7 Objective of the study

The specific objectives of the study are as follows;

- To emphasize the impact of Kudremukh iron ore mining on the social and economical condition of people residing nearby
- To study the impact of mining on occupation structure
- To highlight the impact of mining on migration
- To estimate the impact of mining on landuse
- To examine the impact of mining on Health condition of the people
- To analyze the impact of Kudremukh iron ore mining on Bhadra river sedimentation load
- Estimation of the impacts of mining activity on the soil quality
1.8 Hypothesis of the study

This study is based upon the following hypotheses:

- The closure mining activities have significant socio-economic impacts on livelihoods of local communities for a longer duration such as occupation structure, migration, landuse and Health. The hypothesis can be justified as follows
- The closure mining activities also have significant impacts on the environment like water and soil qualities.
- The nature of mining activities have different impacts on socio-economic and on Environment.

1.9 Limitation of the study

- The present study is carried out in some selected sampling stations which are to the proximity of mining area.
- The impact of mining is attentive only to those sampling station and not to rest of region which lies close to mining area.
- Since all the maps of sample station are unavailable only the sample station maps which are available is given in the present thesis.
- Based on the through study of sedimentation load in Bhadra river region soil sample study was carried out and so only the data of soil samples collected during 2010 is given.

1.10 Scope of the Thesis

Kudhremukha is one of the important National Parks in India (where biodiversity is found). This region is one among the 25 regions in the world where
Biodiversity is found. It is also known for the extraction of iron ore. This region has found a place in the world map because of the availability of Iron ore – and its extraction.

Considering the impacts of mining in Kudremukha on its environment, the supreme court of India has given an order in the year 2002 to stop the mining, which was carried out since 1970. But the question here arrived is, Including Govt. leading Pvt mining companies of India, foreign Govts and Pvt companies abroad are pressuring the Govts both state and Central Govt. to reopen the extraction of ore mining in the Kudremukha. But Govt.s should not agree to the proposals and pressures of Pvt Companies and foreign countries to reopen the extraction. If agreeing to their proposals, Govt thinks of reopening the extraction, It should take extraordinary Measures to protect the environment before giving approval to mining. This study tries to find solutions to the problems imposed due to mining.

- This study will help the Government for planning & execution of programs in a better way.

- Impact of mining on the agricultural land is well understood based on soil parameters and this will be helpful for Agricultural department to take necessary steps to protect & improve the agricultural land.

- This study will enable to take appropriate decisions regarding selection of the best crops which can result in high returns and about alternative crops which can be grown in different periods effectively in the study area. Therefore the present study is important.
• This is one of the initial studies to make first move towards studying the impact of mining on socio- economical as well as environmental after the closure of mining activity.

• This study focus on the impact of closure mine on occupation structure, land use, health, economy etc., of the people residing near to the mining area.

• This study reveals how mining has created problem on water resources in Bhadra River region.

• The seasonal study of the water quality in Bhadra River reveals the change in water parameter which will be helpful for farmers for choosing the crops seasonally.

• This study emphasis the reduction of sedimentation load in which in turn improve the quality of water in Bhadra River.

• The declining fertility of soil in both higher & lower regions is well known by knowing the chemistry of soil. The comparison study with soil standards recommended by ICAR, fertilizer and Department of Horticulture will enable the farmers in choosing suitable crops which in turn will improve the fertility of the soil as well economic statues of the people residing in these regions.

1.11 Organization of Thesis

The thesis mainly focuses on Iron ore mining and the impact caused by these activities on the social and economical condition of the people residing to the proximity of the mining area. It also deals with the environmental impacts of mining activity on geography of the mining area including water and soil quality.
Chapter I deal with the introduction to mining, Importance of mining, Effects of mining/ Environmental impacts of mining as well as the objective of the study.

Chapter II gives the detail note on Distribution of Iron in India, Iron ore deposits of Karnataka, Iron Ore deposition in Chikkmagalur District, Impact of Mining, and Impact of mining on social and economical condition and Environmental Impact

Chapter III begins with the brief note of study area and a note on the geography of Karnataka and Chikkmagaluru District. It covers the detail study of Agriculture Practice and Socio-Economic Infrastructure in Chikkmagaluru District including Industrial Infrastructure, Industrial Estate, Power supply, Financial Institution, Telecommunications, Roads, Transport, Railways, Housing, Health, Water supply and through study of the Present Industrial Scenario in Chikkmagaluru District. It also gives the clear note of Mudigere taluk and the geographical condition of Kuduremukh region including the industrial practice in this region.

Chapter IV deals with the Impact of Iron Ore Mining on Social and economical Condition in Kuduremukha Mining Region. Description of the study area, Data collection and analysis, Social and Economical Condition of People in Mudigere Taluk including Population Structure, Age structure, Occupation Structure, Agriculture crops grown, Health Problems, Migration, Economical conditions of House Hold, House Hold Income and Total Land owned by the House Holds is summarized in this chapter.

Chapter V reflects the impact of iron ore mining activity on environment. The increase in Sedimentation Load in Bhadra River Region, the increase in iron content in the river water, the comparative study of the iron content in river water with the water standards like ISI, ICMR and irrigation standards is mentioned in this chapter.
It also covers the Impact of Iron Ore Mining on Soil Qualities in Bhadra River Region. Analysis of soil parameters like pH, Electrical conductivity, calcium and magnesium, available nitrogen, phosphorous, potassium, organic carbon and iron content in soil is given. The comparison of the results with the ICAR standards, Horticulture standards fertilizer standards is given.
1. Reference

http://www.epa.gov/triexplorer

http://www.worldbank.org/mining.xls


