CHAPTER I

INTRODUCTION

1.0 Prologue

The concept of Development is usually measured by the scale of economic, monetary and financial gains. Industrialization was one of the traditions of economic development and welfare of the population. Industrialization generates various associated and allied activities, such as production, transportation, distribution, consumption of goods and services, which will directly or indirectly deplete the stock of Natural resources on one side and on the other side it also accumulates the stock of wastes in the environment. Industrial and technological development however has always been accompanied by a growing negative impact on the environment in terms of its pollution and degradation. Industrialization carries with it the seeds of environmental damage. Water, soil, air, forest and fishery resources are all affected through the by-products generated by production causing enormous risks to man and environment. Environmental degradation often tends to become irreversible and imposes damaging costs on the economy resulting in human losses. The ecological and social costs of such unrestrained pollution and degradation have put a big question mark on the perceived notion of industrialization as a way of economic development.

Industrialization is to achieve a better quality of life for everyone. A degraded environment means a direct threat to the quality of life and therefore poses a challenge to industrialization. Industrialization has to be there but not at the cost of the environment or for that matter our existence. For this, there has to be a greater awareness about the need for protecting the environment with effective planning and ability to strike a fine balance between industrialization and environmental protection.
Industrialization was considered as the panacea for social and economic development of any region, especially in the case of under-developed countries. Hence, a large number of industrial units, small, medium and large, were established as a part of a comprehensive industrialization drive of our country over the last few decades of the post-independence. However, it is revealed that all is not well with this situation. We find that ubiquitous environmental pollution has been an inevitable by-product of large scale industrialization.

In Kerala almost all water bodies in the coastal zone are polluted by industries. It has been estimated that about 0.5 mm, Society for Protection of Environment (1994) of trade effluent are being dumped into the rivers and the tidal waters of Kerala every day. Periyar, the longest river in Kerala receives effluents from twenty five percent of industries in Kerala. Industrial establishments draw around 169349 kilolitres of water from Periyar daily. Of these 144075 kilolitres comes back to the river as effluents. It is estimated that the tidal waters of Periyar receives 41.4 and 127.9 million liters per day of direct discharges from engineering and chemical industries respectively, Society for Protection of Environment (1994).

The quantity of waste discharged is of the order of 2424 lakh liters per day and the major pollutants identified are suspended solids, mercury, zinc, copper, cadmium, lead, fluoride, ammonia, urea, chlorine, oil, grease and radioactive materials. Today in Kerala, there are about 23 major industries causing water pollution including GRASIM, MAVOOR: Hindustan News Print Ltd., Velloor and Travancore Titanium Products, Thiruvananthapuram Sreekala (1995).

In the proposed research program, it is envisaged to carry out an investigation of environmental degradation and the process of natural restoration of a typical medium scale industrial house that was functioning till recently at Mavoor, Kozhikode district in
Kerala State. The industrial unit was a manufacturer of pulp and rayon from wood using the Kraft method. This industry used to generate large amounts of effluents and Sulfur Dioxide gas among other types of effluents. Several research investigations had indicated that these materials had caused wide-spread damage to the flora and fauna across Mavoor Panchayath and its environs. Mavoor rayon industry is predicted as one of the major disaster areas among the country’s 20 top high risk industries.

1.1 Historical growth and shutdown of Mavoor rayon industry

The government of Kerala was keen to encourage industrial development in Kerala. In its pursuit towards industrialization, Kerala promoted Birla Company to start its rayon unit at Mavoor with an agreement they were ensured ‘exclusive’ rights to extract any natural resource from the area earmarked for them. In 1958, when the agreement was signed, the area was limited to Nilamboor Valley. However in 1962, when the factory was ready to begin production, through a Supplementary Agreement, the area of their reach was increased to include a substantial portion of Malabar i.e. Kozhikode, Wayanad and Nilamboor forest divisions. By 1985, the entire forest area in the state except the Quillon Circle was set apart for bamboo and eucalyptus extractions.

This industry supported for the development of all facilities and infrastructure of this region such as transportation, Schools, hospital, Police station etc. In 1985 Grasim shut down for lack of raw material chiefly bamboo for 3 years, which caused 11 suicides in Mavoor itself chiefly due to the complete dependence of the local population upon Mavoor industry for livelihood. At last in 1988 the Government offered more concessions to the management and the factory re-opened with higher targets of production and the situations of pollution became worst with increase in the amount of production.

At first the company had only one unit of production, which was based on pulp manufacturing. In 1968 the second unit fiber division started its production and thereby
the pollution increased. The company acquired 30,000 acres of forest land to raise industrial plantation of eucalyptus. Every year 2,500-3000 acres of natural forests were turned into eucalyptus jungle. There was a ruthless exploitation of forests leading to a diminution in the supply of bamboo and eucalyptus and as a consequence shortage in the supply of raw material.

The industry consists of a rayon grade pulp division, a viscose staple fiber division and a paper plant. The pulp division employs over 4,000 workers and is the most significant in terms of employment. The fiber division employs 500 and the paper division employs around 1000 workers. Apart from nearly 6000 workers who are directly employed, about 10,000 people are indirectly dependent on the factory for their livelihood Mohan (1988).

After the opening of the rayon industry the land use structure of the region has underwent enormous change causing great impact on the natural vegetation, and agricultural lands. The industry was also a source of severe environmental hitch to the region’s air, and water. A large quantity of pollutants produced by Grasim ended up in the Chaliyar river which flows beside the factory. Environmental organizations started agitations focusing on this aspect of the factory. A series of labor strikes and heightened trade union was also witnessed at the plant. All these factors contributed to the shutdown of Gwalior Rayons in 2002.

1.2 Statement of the problem

The environmental problems arising from GRASIM spreads over two villages’ viz., Mavoor in Kozhikode district and Chungapalli in Malappuram district. They both face the problems of air and water pollution. The smoke from this factory blows southward and south-eastward. Thus the toxic fumes affect the people of Chungapalli,
besides, their crops and livestocks. The toxic gases responsible for air pollution in the area are hydrogen sulfide, carbon disulphide, carbon monoxide and chlorine.

Years back people of the villages of Mavoor and Chungapalli used the river water for drinking, bathing, irrigation, fishing, shell picking and for many other purposes. As the factory expanded pollution of the river became acute and severe. The river water sometimes turned into black soupy liquid, foul-smelling and hot at times. Killing of fishes became common. In June 1982, one of the pipes broke and caused havoc. People in the region insisted that they would not allow the repair of the pipe line unless the factory undertook to treat the effluents to the prescribed effluent standards, before discharging through the new pipe line. The factory filed a petition in the High Court seeking police protection. The judgment was decreed in 1982, that the factory should at first install the treatment facility and then seek police protection.

According to a study, the concentration of heavy metals like mercury and lead were very high at the downstream of the river, whereas it was zero at the upstream, revealing clearly the role played by the factory in polluting the river water. As per the study, the downstream water showed a mercury concentration varying from 0.007 Mg/L to 2.871 Mg/L and lead from 0.951 Mg/L to 2.613 Mg/L \(^2\) (The prescribed limit of mercury in effluent water is 0.01 Mg/L and 0.1 Mg/L for lead). According to a paper presented in the 1994 Kerala Science Congress, the waste water discharged from GRASHI contains mercury in high quantity Bowonder (1995).

The most toxic air pollutant at Mavoor is sulfur dioxide. Carbon disulphide liquefies quickly, settles on the vegetation and destroys them. This will cause reduction in yield in coconut, cashew, aracanut, jack fruit and pepper. It has been well known that certain medical camps and preliminary health check-ups had earlier been conducted at
Chungapalli. Such surveys showed that lung diseases, anemia and skin diseases were wide spread in this area.

The people residing in Chungapalli are severely affected by air pollution, as it is situated in a hill top, bringing the chimney of the factory on the same height. The people are forced to breath the polluted air in which concentrations of sulfur dioxide is very high. This has resulted in increased rate of respiratory diseases. In 1991 one of the pipes of the effluent outlet burst at Kayalam and a few people in the adjacent areas were hospitalized because of the acute effect of inhaling noxious fumes that arose from the broken pipe line. A study conducted by Dr. T.K. Gopinath of Calicut Medical College clearly demonstrated that 23% of males and 20% of females inhabiting in the Chungapalli - Mavoor areas have Cardio-Pulmonary disease as a result of exposure to polluted air World Resource Institute (1994) Wind will carry this dry effluent to the atmosphere and it will cause itching when skin is exposed to it. The dry effluents are often consumed with food materials which are kept open and they will reach the lungs through breathing. This will cause different kinds of health problems, varying from headache to asthma. The environmental problems created by GRASIM to the locals can be summarized in the following words as observed by Honorable Justice K.K. Narendran. "The banks of Chaliyar, once a health resort, have virtually become a hell on earth.

1.3 Meaning of environmental degradation and natural restoration

Industrial effluents pollute the environment. The pollution can be anything water, air, soil either individually or a combination, or all together. The effluents can be dangerous health hazards. Once the pollution has occurred, it takes a long time for these elements of environment to be truly cleaned. This process of cleansing is called restoration or remediation and it is an important part of preserving our natural resources. The process of restoration could be two types:
1. Natural process of restoration.

2. Artificial process of restoration.

The natural process of restoration is left for the nature to clean by its own methods. The rain water and the winds are the two main methods by which cleansing of the environment can take place without the human intervention. This method may not involve any financial costs but it takes a long period to totally complete cleaning of the entire region.

The second method is where the environment is expected to be cleansed with the help of service agencies who may cleanse the environment by their own tools and techniques depending upon the nature and extent of pollutants. The later method is conducted quickly but it may be quite a very costly affair.

1.4 Conceptual model of the study:

![Conceptual model](image-url)
1.5 Aims and objective of the study

The specific objective of the study area

1. To study the air pollution of rayon industry and the nature of natural restoration of pollutants in the atmosphere.
2. To assess the water pollution of rayon industry and the nature of natural restoration of pollutants in the Chaliyar River.
3. To identify the impact of rayon industry on the quality of Soil and the stages of deterioration and nature of natural restoration.
4. To identify the Land use and land cover changes in the study area.
5. To study the impacts of the rayon industry on the various social & Economic characteristics in the study area.

1.6 Hypothesis

1. Environmental elements such as Air, Water and Soil are the key elements to determine the intensity of environmental impacts; they tend to gradually improve after some time.
2. Industrial shutdown is one of the keys for diversification of occupation, and out migration.
3. Industrial shutdown can create a positive manifestation upon the human health.
4. Industrial shutdown has strong impact on Land value and Standard of living.

1.7 Relevance of the study

1. Environmental restoration by means of natural process is a natural strategy which can be applied anywhere, and promotes sustainability of the environment and preserve and protect the country's natural resources.
2. This strategy can help us to understand at what rate the environment is becoming neutral, and it is also possible for us to predict how many more years it is required for the total restoration of the environment.

3. Studies of environmental restoration, can be useful for prevention strategies, because handling an environmental emergency is always more costly than taking preventive measures.

4. This study therefore can be very relevant and it may set as an example at the time of making decisions regarding the installation of a particular industry. Such studies become handy and help government to visualize the stages and extent of environmental degradation which may be possible in course of the functioning of a particular industry. This will help in promoting safe environment and minimize risk and avoid potential lawsuits.

5. Environmental restoration studies also help in making land use planning, planning for a recreational; residential; or an educational land use generally require good and clean environment. Whenever a polluted region needs to be put to any land use, at first it should be ascertained whether the region has been cleared of all the pollutants. In case if any pollutants still happen to be noticed, then the administrative agency could wait until the pollution is totally cleared. In order to take all these decisions restoration results become very essential not only to understand the stages of the clearing but also to make future predictions.

1.8 Methodology

The above mentioned objectives are accomplished by the researcher by employing various appropriate approaches, tools and techniques. These methods are partly empirical, and partly analytical. It is empirical since it depends to some extent on the primary data through field observation and survey. Primary data are collected especially
for data related to health, migration, and income of the people. A number of secondary information including governmental reports, internet web sites, and reports published both by Government and independent agencies, news papers, research articles etc., are made use of for the purpose.

The environmental data was collected from the Kerala pollution control board and Center for Water Resources Development and Management. The components for air are NO2 (Nitrogen dioxide) and SO2. (Sulphurdioxide) While for water the components are pH (Hydrogen potential), BOD (Biochemical oxygen demand), TH (Total Hardness), DO (Dissolved solid), Iron, COD (Chemical oxygen demand) etc. It is analytical in so far as it tries to analyze and project the environmental impact of industrialization and quality of environment using the different environmental components at different stages of time periods and it also evaluates the degradation and the logical stages of restoration. It studies the impact on the socio economic characteristics and upon the land use and land cover, most particularly the changing patterns of natural vegetation.

GIS and remote sensing has been used for the purpose of spatial data mining, data preparation and spatial analysis. GIS has also been used as a tool for conducting cartographic work and preparation of thematic maps.

1.9 Limitation of the data

1. For the recent data, IRS- LISS III Imagery of 1995, 2000, 2003 and 2005 from NRSA and 1990 image of land sat was taken. Among this the land sat and LISS images the spatial and spectral resolutions differ between each other.

2. The use of two different types and sources of data (satellite imagery and Toposheet) for spatial analysis was another factor of limitations to the study. Moreover there was no alternative but to work together with Toposheet data and satellite data although they have different nature of data acquisition.
3. Most of the data accuracy is more than 90%, but it also based on very few people existing their and most of them have migrated. Their data was possible to be collected.

4. Medical health data related to patients in the hospitals was not available, but it had to be collected by primary survey and suffers from obvious setbacks because of scarce documentary evidence.

5. The data for pollution was collected from the pollution control board we were restricted to study about the variables which had been collected by them. Since the data is based on time scale, we could not get information concerning many other variables allied to the contamination of heavy metals in water.

1.10 Organization of the thesis

The present study is divided into seven chapters.

1. **First chapter:** The first chapter is Introduction. This chapter includes the conceptual model of the study, review of literature, methodology, objectives and hypothesis, scope, and limitations of the study.

2. **Second chapter:** The second chapter is the review of literature. The review is conducted for each of the objectives.

3. **Third chapter:** This chapter deals with the detailed description of the study area including all the socio economic and physiographic characteristics of the study area. Like historical background of Mavoor and its environment, location, Physiography, climate, land use, geology, drainage, communication, demography, occupational structure, industry, amenity, and transportation of the study area etc.

4. **Fourth chapter:** The fourth chapter is based on the impact of rayon industry on the air quality: it includes air pollution like (nitrogen dioxide) NO2 and SO2 (sulfur dioxide). Spatial and temporal distribution.
5. **Fifth chapter:** The fourth chapter includes the impact of rayon industry and environmental stress on surface water quality. This chapter clearly shows the water quality and related problems in the environment, water pollution in the study area, remedial measures’ using for the pollution, effects of the water pollution and its restoration etc.

6. **sixth chapter:** The sixth chapter deals with the soil quality changes before and after the closure of the rayon industry. Among this the parameters like hydrogen potentials, electrical conductivity, sodium etc are dealt with respect to spatial distribution.

7. **Seventh chapter:** the seventh chapter deals with the land use Land cover changes on the study area. This chapter covers the topics of land use in different stages of and ultimately the land cover being influenced by the industrial shut

8. **Eighth chapter:** The eighth chapter deals with the socio economic factors and migration of the local laborers as a result of the industrial shutdown. Occupational changes, change in land value and change in health conditions etc.

9. **Ninth chapter:** this chapter deals with the conclusion with necessary suggestions and discussion.