

A STUDY IN ENVIRONMENTAL DEGRADATION IN THE DARJEELING HILL AREAS

Introduction

i. Scope of work

In the Darjeeling Himalaya, environmental degradation and the consequent deepening crisis has reached such a stage, where it is difficult to maintain the ecological balance – leading consequently to environmental hazards like soil erosion, pollution, landslides and loss of biodiversity. Thus the serious concern is for finding the right way for checking such degradation. Whether, through ignorance or otherwise, the fragile hill ecosystem has often been violated outrageously, impairing its delicate sub-systems which have a long term effects, jeopardizing the life-sustaining process. The growing consciousness about the worsening situation compels the society today, to halt and ponder on the grave consequences of such degradation. While, it is admitted that the environment cannot be reverted to its original form, nor can it be intended to, it may not be beyond our conscious efforts to check or control such practices for arresting further deterioration, followed by protective measures for speeding up the restorative processes in the environment.

The Darjeeling hill area is a region with wide variety of renewable and non-renewable resources. Of late, this repository of natural wealth has been subjected to virtual plunder and consequently, the hill ecosystem is fast loosening its resilience and regenerative capacity.

Since the British occupation, the physico-cultural set-up of this region has been seriously disturbed. Extensive heedless deforestation, tea plantation, haphazard construction, huge population influx induced illogical slope cultivation, inadequate drainage, in other words, unscientific and unplanned use of land has led to the establishment of vicious cycle of degradation. As a result, during heavy and concentrated rainfall, catastrophic soil erosion and innumerable landslips are caused, contributing huge sediment load to the rivers which are incapable of transporting the load efficiently under the existing hydrological conditions especially along their lower courses beyond the foothills. The river beds are rising, resulting in lessening of cross sectional area, which being incapable of arresting unusual monsoon discharge and cause devastating floods, endangering the vital line of communication, human habitations, farm lands and forests.

Erosion, transport and deposition are primarily nature's way of adjusting hill slope form and processes. Such an adjustment has been found to be deleteriously disturbed by the

human interferences. Implementation of various development schemes, construction of human settlements and roads to cater to the ever-increasing population, exploitation of forest produce to generate work potential, boosting of agricultural growth, tourism, mining and quarrying on the Himalayan immature geology trigger the disaster, huge and complex, never encountered before.

The fast growing population and the human aspirations for a better standard of living have increased pressure on land situated on delicate and susceptible hill slopes. The felling of trees for timber, fuel, fodder, building construction, road construction, dams and canal construction and the development of sites for tea gardens, arable farming have seriously damaged not only the vegetal cover but also caused irreparable damage to the hill slope hydro-geomorphologic processes operating thereon. The degradation is increasing on account of fast depletion of grazing lands, wild animal, rare plant and natural sources of water i.e., springs etc.

Deforestation has not only seriously affected the output of fodder, fuel and food but also destroyed the homes of numerous tribal communities, birds, reptiles and wild animals. The Social Forestry Programme initially set up to alleviate the fuel and fodder shortage, has in fact become an instrument to provide raw material to the paper, pulp and building industry, thus ignoring the very people it was designed to help.

Increasing number of vehicles along with carrying additional load not only damage the existing road network but also found to be instrumental in causing landslides and related phenomena. Use of age old motor vehicle along with the sub-standard and adulterated fuel by many vehicle operators has contributed pollutants to the already polluted environment of the Darjeeling hill.

The climate of the Darjeeling hill areas is undergoing a rapid change over the past hundred years. The mean annual temperature recorded at Darjeeling and Kalimpong stations has been increased considerably in association with considerable decrease in relative humidity. As a result the net biological demand for water has increased. Consequently, rainfall occurrences during the same period although does not show any clear tendency yet indicates not only erratic nature but also a clear indication of increasing frequency of high intensity short lived rainstorm. The study also reveals decreasing number of rainy days in Darjeeling hills. As a result, the Darjeeling Himalaya has been experiencing acute water shortage especially during non-monsoon months. Innumerable perennial water sources have

dried up. Edaphic drought has become prominent in most part of the hills causing irreparable damage to the flora and fauna of this biodiversity hotspot.

Because of the burgeoning population of human beings and livestock, the forest and grassland resources have been overexploited. This has resulted in multidimensional environmental crisis which in turn have created air pollution, soil pollution and water pollution.

The aforesaid kinds of environmental degradation in the Darjeeling Himalaya are playing havoc not only on human being and animals, but also on the vegetative kingdom. Premature deaths due to respiratory and cardio-vascular diseases like asthma and bronchitis have increased. Lead emitted in the atmosphere from auto exhaust is causing lead poisoning of human body leading to stomach ailments, indigestion, constipation lack of appetite and sleeplessness as dust from quarrying/mining and grinding, stone crushing and other factories leaves trace elements in the atmosphere.

The unplanned construction of high rise buildings in urban areas, a majority of them illegal, has led to deterioration of delicate hill slope stability of the Darjeeling hill areas making the place more vulnerable to landslides and related slope failure processes. Landslide which was a minor natural phenomenon hundred and fifty years before has in recent years become a serious threat not only to the urban area but also to the roads and railway. The glaring example is the fact that the World Heritage title winner, the Darjeeling Himalayan Railway forced to suspend its services for a period of two years.

At this moment, suggestions of restorative and regenerative measures and their active implementation is of vital concern to the region as a whole, as the amelioration of very existence of habitable environment and its sustenance in Darjeeling Himalaya depends on it.

ii. Hypothesis

Environmental degradation in the Darjeeling hill areas has reached an all time high. The Darjeeling hill areas are facing the worst ever crisis even in providing the basic life support input to the inhabitants. The unplanned ecological plunder in the region has been gradually extending to the far distant corner of the hilly area. If such haphazard development programme in Darjeeling Himalaya are not properly reoriented and/or reversed through a viable eco-friendly and sustainable alternative, the situation will assume catastrophic

dimensions. The environmental damage in the Darjeeling Himalaya sounds like the death-knell not only for its inhabitants but also millions living in the surroundings.

iii. Objectives

The main objective of the present study is to (i) assess the causes and consequences of environmental degradation in the Darjeeling hill and (ii) to suggest the remedial and restorative measures. To achieve the above, the following detail objectives have been identified:

1. To examine the historical aspects of development in the Darjeeling hills.
2. To reconstruct the past environment during the different phases of development and comparing its impact during these different periods.
3. To assess the extent of climate change and its impact to the environment, economy and society.
4. To examine and analyse the land use changes over the past hundred years.
5. To assess temporal and spatial aspects of degradation and hazards with special references to landslides and soil erosion.
6. To examine the development of tourism and its impact.
7. To examine the development programme and its impact with special reference to hydroelectric project.
8. To examine the consequences of unplanned development activity.
9. To assess the extent of human encroachment vis-à-vis over use and misuse of environment.
10. To assess the environmental impact of various development programmes.
11. To evolve suitable module for the restorative and regenerative measures.

iv. Study area

The Darjeeling hill areas comprising of the three hill sub-divisions of Darjeeling district of West Bengal is bounded by latitude 26° 31' to 27° 4' N and longitude of 87° 59' to 88° 53' E is endowed with a perfect blend of physical, cultural and aesthetic resources. Of late this repository of natural wealth has been virtually plundered and as a consequence the Darjeeling hill is fast loosening its natural resilience and regenerative capacity.

The area of study comprises of eight block viz. Darjeeling Pul bazaar, Jorebunglow, Sukhiapokhari, Rangli Rangloit, Mirik, Kurseong, Kalimpong I, Kalimpong II, and

Gorubathan I block. The attempt has been made to study all the hill blocks which are bounded by Nepal in the west, Sikkim in the north, Bhutan in the east, Jalpaiguri district in the southeast and Siliguri sub-division of Darjeeling district in the south (figure 1.0).

The Darjeeling hill started finding mention after the British colonizers took control of it by default as there is hardly any native account of this region. The region was sighted first by G.A. Lloyd and J.W. Grant in 1828. Capt. Lloyd was deputed to negotiate on behalf of the East India Company with the ruler of Sikkim, which was accomplished by 1st February 1835. The Christian Missionaries who started the European system of education around the middle of nineteenth century have recorded most of the information relating to its history and physiographic, flora and fauna people and their practice including culture and politics.

v. Methodology

To fulfill the objectives, rationalistic methodology been adopted by the present investigator, comprising of integration of data collected from both primary and secondary sources and the application of standard methods and techniques to analyse them. The proposed methodological framework for the study comprises of the details outlined as follows:

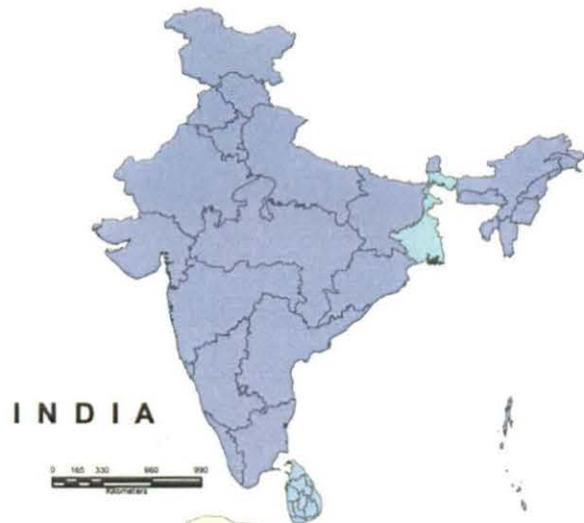
Reconnaissance survey

The investigator has obtained the basic aerial data from different government organizations, from maps published by the Survey of India topographical sheets (1:50000 and 1:63360), US Army topographical maps (1:250000), Satellite imagery (Google), manuscripts and report gazetteers etc. and from the work of individual researcher. These have been used under GIS platform (ArcGIS 9.2) in preparing the detailed programme of the present research work. Significant changes of the environmental characteristics of Darjeeling hills has been followed by comparing the old documents, photograph with the present one.

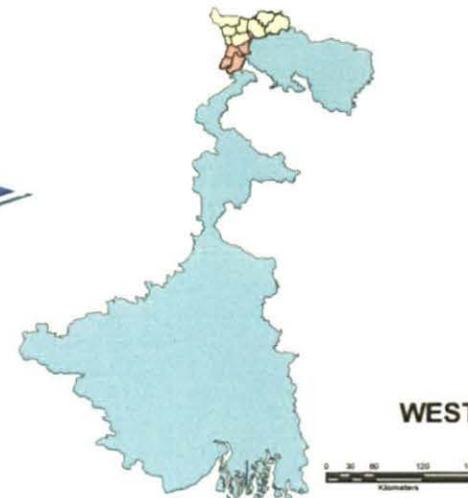
Scheme for data collection

The scheme for data collection has been carried out in two stages. Firstly, different relevant data has been collected from primary source i.e., by direct measurement at the field based on questionnaire survey. Secondly, relevant data has been collected from different sources like records of Geological Survey of India, records of the Forest Survey of India and Director of Forest, Government of West Bengal and from previously published reports. The reliability of the data collection from secondary sources has been properly scrutinized.

LOCATION OF THE DARJEELING HILLS, WEST BENGAL



INDIA



WEST BENGAL



DARJEELING HILLS (STUDY AREA)

The investigator has also obtained data and necessary information from the secondary sources like Census handbook of Darjeeling, District Gazetteer, Statistical Handbooks etc. The data has been also collected from different line departments, NGOs and semi-government organisations.

Primary information has been collected from field surveys mainly by questionnaire method in identified key areas of interest especially to study the perspective on environmental degradation. Extensive field survey has been carried out in vulnerable areas to understand the processes and factors of degradation mechanism and to apprehend its mitigation processes.

As the standard data on various aspects of environmental degradation is not readily available the investigator has used the standard methods of questionnaire, interview, meeting, correspondence with the respondents in Darjeeling hilly area.

Meetings and discussions with the concerned departments, senior citizens and local people were held in the various parts of the hills including forest villages. This has done to incorporate their views and suggestion in formulations of the strategy for protection of forest within broad principles of joint forest management and people participations.

Letters were issued to different organization and senior citizen to get information in order to fill the gaps in the process of reconstructing the past environment in the Darjeeling hills. Information and data have been gathered with the help of interview schedules. Apart from the schedules observations were made and other general information about the extinction and threatened species have been collected from the elder members of the villages and gram panchayets.

Methods for assessing land use changes and deforestation

Chronological assessment of depletion of the forest cover in the Darjeeling hills has been done under GIS platform using US Army Topographic Maps (1:250000) for the year 1930s, Survey of India topographical maps (1:50000 and 1:63360) during 1960s and 70s, Satellite image available from NRSA (LISS 3) for 2000 and Google image (2010). The time series data thus accessed has been analysed quantitatively to apprehend the nature and extent of land use changes vis-à-vis the extent of degradation in Darjeeling Himalaya.

Methods for assessing of land degradation

Assessment of soil erosion has been done mostly from secondary sources (FAO/UNEP/UNESCO, 1978) and Sarkar (1998). The quantification has been made based diagnostic criteria of (i) climatic erosivity (R), (ii) topographic erosivity (L.S), (iii) soil erodibility (K) and biological erosivity (C.P). Data thus collected from various institutional sources have been followed by field checking by the investigator when have been analyzed and processed to provide logical and sustainable restorative measures.

Assessment of landslides and related phenomena has been based on both primary and secondary source of information. A number of case studies have been performed by the investigator to apprehend the nature and extent of this hazard in Darjeeling hills. The investigator also had applied check list method on 80 sites to study the spatial patterns of landslide degradation in different parts of the Darjeeling hills. An attempt has also been made to identify the landslide prone areas of the Darjeeling Himalaya.

Methods for environmental impact assessment (EIA)

Modified Leopold matrix (1971) has been used to assess the environmental impact of development programs in the Darjeeling hills which involves several development activities under considerable broad headings and number of environmental components under different heads and sub-headings. Environmental impact has been identified under the heading of impact significance and impact magnitude. The matrix has been applied on checklist filled up at 80 different sites across the Darjeeling hills.

Data Processing and Analysis

The investigator has analysed the nature of the terrain, geomorphology of catchment area using standard method. The land use pattern of the watersheds has been assessed from the topographical maps and updated by using satellite imagery under ArcGIS 9.2 platform.

As mentioned earlier that data has been collected from various sources. The reliability of the data collected from secondary sources has been checked statistically. The following methods have been applied to understand the processes and extent of environmental degradation in Darjeeling hills

- correlation analysis
- regression analysis
- linear and log linear analysis

- matrices
- factor analysis

Long term climate data obtained from various sources i.e., India Meteorological Department, SDO, Kalimpong, Planters Club, Darjeeling, Forest Department, Government of West Bengal has been statistically analysed for understanding the trend and the probability using MS excel and SPSS 15.0.

To compile the bibliography as well as reference work, the libraries of North Bengal University, Natural History Museum, Darjeeling, National Library, Kolkata, Planter's Club, Darjeeling, Public library, Kalimpong, District library, Darjeeling has been thoroughly consulted.

Finally, in order to understand the environmental degradation problems of the Darjeeling Himalaya, all the data collected from the field and various institutional and personal sources has been analysed, processed to provide workable suggestions of sustainable nature for restoration and regeneration of the degraded environment of Darjeeling hill areas of West Bengal.