

## CHAPTER V

### Causes and Consequences of Environment Degradation

#### 5.1 Introduction

The environmental degradation in Darjeeling hills are caused by many complex and interrelated factors i.e., scarcity of resources, accelerated soil erosion, landslides, droughts, floods, declines of forest cover, decline in agricultural yields, problem siltation, shrinking of bio-diversity etc. The natural springs are rapidly drying up, domestic animals are less productive and/or reproductive. The fodder resources are shrinking and are fast disappearing from the Darjeeling hill areas.

Blasting of rock for construction materials for roads, bridges, culverts, tourist lodge, hydro-electric power projects, residential apartments coupled with unscientific and unplanned mining/quarrying along steep and fragile hill slopes have been greatly effecting the hill slope stability. Unregulated quarrying have also degraded the lush green hill slopes and thereby depriving the nearby cultivated land from the valuable organic matter the storehouse of natural nutrients for plant growth.

In Darjeeling hills soil erosion caused by running water is a serious problem as it make the parent rocks bare and exposed to further degradation by weathering processes and ultimately make susceptible to slope instability. As a result, high intensity rainstorms cause mass wasting including landslides. Landslides are very common often blocking the vehicular traffic and some time damaging engineering structures. While in the foot hills and valleys flash flood induces accumulation of large debris.

The infrastructure development often found highly unplanned and been executed without considering the possible environmental impact of such adjustment within the natural system. Construction of dams/reservoir across the mountain torrents to meet the ever increasing demand of power is yet another factor of environmental degradation. These projects have already caused irreparable damage to the delicate hill ecosystem particularly destruction of fertile flat land of the valleys and also created the problems of rehabilitation of the affected families as well as the immigrants.

The aim of this chapter is to analyse the various causes of environmental degradation in the Darjeeling hills. It also aims to assess the consequences of such degradation in the area.

The data collected from various secondary sources i.e., reports, monographs, manuscripts, contribution of earlier authors etc. The investigator has also conducted field study to gather primary data/information from the problem areas. The analysis has mostly been qualitative in nature.

## **5.2 Causes of environmental degradation**

Environment is a union of non-living components which render favourable habitat for the biological development. The elements of environment are always active to protect these biological live sustaining processes in close co-ordination with them. When, the elements of environment are in danger mostly caused by illogical anthropogenic activities the degradation becomes visible. Among such processes deforestation, over population, misuse and over-use of natural resources are common. As a result the elements of environment become unsupportive. It is evident that the human are mainly responsible for the degradation of environment. The ecological balance remains healthy if the mutual activities of human beings and the environmental agents work together in consonance. But, if the human being acts negatively the environment degrades and these happen when anthropogenic activities destroy the essential elements of nature. Such as, the use the chemical fertilizer in order to produce more food to cater the increasing population eventually invites soil degradation that ultimately leads to sterility.

### **5.2.1 Economic causes of environmental degradation**

The natural resource of Darjeeling hill area has been overused by the people. Natural forest has been almost cleared near urban centres and major settlements. As a result, the poor people of hill area are facing severe problem of fuel and fodder. The shortage of cooking gas aggravates the problem further. The rural people are not getting grass for their domestic animals and unable to keep such domestic animals like cow, goat, buffalo etc. to augment supportive economic activities forming a vicious cycle of deteriorating economic condition. Out of desperation many poor villages indulge in illegal and unethical acts like putting forest fire, trapping engendered animals etc. for their survival. Such act has been proved even more detrimental from the point of view of environment and perhaps put the final nail to the once much acclaimed biodiversity of Darjeeling hills.

The poorest of poor villagers of Darjeeling hills for long being depend on forest for gathering various forest produce of food, fibre and fuel for their sustenance. Even the drinking water was also fetched from innumerable springs scattered in and around the forest.

Large scale deforestation in Darjeeling hills in fact, sealed up the very life sustaining processes of this vulnerable section of our society. The following services vis-à-vis economic returns from the hill the forests have lost forever:

- a) providing fuel and fodder for the rural people particularly the poor landless and marginal families almost free of cost,
- b) providing timber of average quality for rural dwellings, to rural artisans for making tools, implements etc. almost free of cost to support rural vocations and economy,
- c) providing to maintain a steady supply of raw materials needed for paper making, plywood and other forest based industries,
- d) providing high quality timber and some fuel for the urban population i.e., charcoal, firewood,
- e) providing invaluable support in maintaining hill slope hydrological cycle, soil conservation, moderating climate, maintaining aesthetic value of the overall environment and
- f) providing shelter and life sustaining module to the biodiversity.

Fire wood constitutes a major share of the fuel used by rural population of Darjeeling hills for cooking their daily meals. The requirement of fuel of the rural hilly areas has been found tremendous just next to the food and the 60% of Darjeeling's population is still have no other stable source of fuel.

There is a close relation between natural resources and economic development. A country having an abundant supply of natural resources is always at an advantage. It can achieve faster growth than resource-poor countries. However, with economic development more and more resources are consumed. This may lead to depletion of resource base with development. If this happens the performance of rich in resources developing countries would be ever worse. Most resources, the people of Darjeeling use for their subsistence are renewable by nature (water, soil and biotic). They can regenerate themselves, given time. It is possible to exploit renewable resources sustainably if annual harvest not exceeds the annual growth of the stock. The difference between the rate of harvest and the rate of growth is called the rate of depletion. The more quickly these resources can be replenished, the faster the economic growth than can be sustained indefinitely.

Sustainability can involve the depletion of natural resources and the eventual decline of farming, fishing, forestry and other sectors depend on natural resources. Since

resources are scarce, they are to be exploited efficiently. The substitution of man-made natural resources may not be productive unless, technology continues to reduce this dependence on raw materials. Furthermore, if population continues to grow and if a society wants to grow by increasing its per capita income, then it must invest more to protect the natural environment as also to continuously increase the supply of renewable resources and conserve non-renewable ones. If a society can do it, it will be able to achieve the sustainable development.

### **5.2.2 Social Causes**

It's a matter of grave concern that large majority of people living in Darjeeling hills shows their grave ignorance and indifferent attitude to the ever deteriorating condition of the over-all environment of the Darjeeling Himalaya. The people are unaware about the environmental problem every year bad days are coming. No body is serious about the environmental damage. The people do not discuss for measures for protection of environment even among themselves.

Of late, only a very small section of people are living in worst affected villages and a number of NGOs have come forward at the village level seriously for the awareness campaign and protection of environment. As a result, the hill society is gradually geared up with the much needed environmental awareness vis-à-vis eco-restoration programme in Darjeeling Himalaya for the sustenance of the unique priceless gift of the nature.

### **5.2.3 Political Causes**

Political instability couple with continuous influx of people in the Darjeeling hills poses serious threat to her delicate environment. Periodic socio-political agitation especially statehood movement in Darjeeling hills often shifted the focus of administrative as well as societal eco-conservation and eco-restoration measures. The situation becomes periodically conducive for the extractors, builders and unscrupulous business man to exploit the priceless environmental resources ruthlessly. Field observation reveals that large scale valuable tree felling had taken place all over the hills including its famous National Parks like Naora and Singalila during the GNLF movement.

The environmental degradation in Darjeeling hills during the agitations reached all-time high. Massive heedless deforestation, ever-increasing landslides, accelerated soil erosion, edaphic drought, dwindle water supply etc. are the major ramification of degradation

of hill environment. Along with these, the possible ramification of climate change over hill environment, economy and society is perhaps would be the major issue in years to come.

Environment has never been considered a political agenda in the Darjeeling hills as no political organization has ever made any environmental issues their agenda. Neither the administration nor the society has ever displayed their concern over environmental issues and as a result, all environment conservation/protection/safety related acts remain only in books for academic interest. From the beginning of this century, a section of the society has finally realized the grave situation and formed NGOs, with an objective to create awareness among the hill people about the ground reality. The civil society thus can ameliorate the problem by being the interface between the ravaging of the environment and the perversion of politics on one hand and creating awareness at the grass root level on the other.

It is a fact that day by day environment of Darjeeling hills has been degrading through misuse and overuse of her natural resources. But politically nothing has been done for the protection/conservation. Essentially, there is a lack of political attitude and focus for implementation of various environment friendly laws and guidelines for sustenance. There is urgent need to establish a high power autonomous body in Darjeeling hills to formulate implement and monitor different environmental conservation and protection measures.

#### **5.2.4 Natural Causes**

Environmental degradation has also been caused by natural processes. Among them forest fire, high intensity rainstorms, landslides, earthquakes etc. are important. Natural forest fire is common in Darjeeling hills during March-April when hill slopes become very dry and strong wind blows. The coniferous forest of high altitude has been found especially sensitive for such degradation. Large tracts around Singalila National Park affected by natural forest fire during the end of 19<sup>th</sup> century which still remain visible even after a century.

Landslide and associated phenomena is one of the most pervasive of natural processes that undermine the socio-economic development of Darjeeling hill areas. With rapid modernization, the Darjeeling Himalaya at present is experiencing a phenomenal growth in population (456%) during last 100 years). To cater to such an overwhelming population, pressure on the land is ever increasing. Forests have gradually been eliminated, steep slopes, generally unsuitable for human habitations and arable use have already been occupied and as a result Darjeeling Himalaya has of late turned into a highly vulnerable region without paying

any heed to its ecological imbalance. Curiously, landslide, which was a minor physical phenomenon in Darjeeling a hundred and fifty years ago, has become quite rampant now-a-days leading to great loss of life and heavy damage to land and property. At present, therefore, suggestion of remedial measures and their active implementation is of vital concern for this extremely sensitive region.

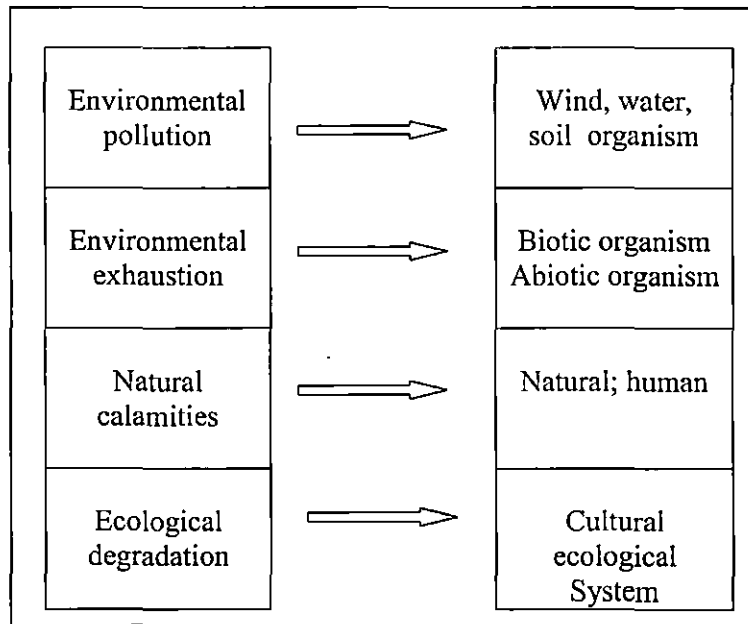
Ever since, the British occupation, the physio-cultural set-up of this region has been seriously disturbed. Extensive heedless deforestation, haphazard construction and inadequate drainage, in other words - unscientific and unplanned usage of land, have led to the establishment of the vicious cycle of degradation, heavy and concentrated rainfall aggravating soil erosion; landslide and associated phenomena (Basu & Sarkar, 1987). Since 1980 onwards, it has been found that almost every year some parts of the hill have been suffering from major or minor landslides and thus, it has become an integral part of the life of the hill people (Photographs 1-12).

In addition to forest fire and landslide erratic occurrences of precipitation and earthquakes also caused detrimental effect to the environment of Darjeeling hills. Due to less rain the water table goes down and scarcity of drinking water has been faced by the people. Acid rain and black rain have been appeared in this hilly region. So, the different kinds of plants and vegetables have been destroyed. The marigold of hill area have been lost for last three years, the cash crops of this region is cardamom whose production capacity have been decreased by 80% due to unknown disease. Elderly villagers are in opinion that acid rain and black rain caused irreparable damage to the famous floriculture and horticulture in hill slopes of Darjeeling hills.

### **5.3 Consequences of Environment Degradation**

The basic needs of human are available in the nature like water, air, food, fibre and shelter and exploitation/extraction of such needs begin the front of man-nature interface. Over use and illogical exploitation/extraction leads environment degradation. Due to ever increasing and over exploitation of natural resources, the environment of Darjeeling Himalaya gets degraded and the consequences can be summed up as follows (figure 5.1):

Air the inexhaustible resource for living, is being polluted due to rapid urbanization and industrialization. Air has been polluted because of socio-economic short-term gains. Although air pollution in Darjeeling hills is not noteworthy yet people awareness should be developed immediately to avoid long term adverse consequences.



*Figure 5.1: Environment degradation and consequences*

Like air water is also the basic need for life. The surface as well as ground water resources have greatly been polluted due to urbanization and industrialization. The spring water sources in hill areas have been dried up, due to deforestation and over grazing in catchment area. This can be seen from the decrease in its supply in all the urban areas of the study area. The water supply for Kalimpong town and surrounding area was laid down during the British period. By the beginning of 21<sup>st</sup> century the virgin forests of Lava, Rachel range where the water source is situated have been cleared. As a result, water yield is declining and if deforestation continues and the remaining small sources of spring water are no longer perennial.

Men have been taking shelter in the lap of nature. The nature is nurturing the entire human race. But the materialistic desire of human being, the urbanization and industrialization has destroyed the beauty of nature. Extraction of building materials and minerals from the hill slopes has also lead to the degradation of environment.

### **5.3.1 Economic Consequences**

The economic consequences of environmental degradation on various products have been assessed for the most likely scenario in Darjeeling, Kurseong as well as Kalimpong sub-

division. The level of dependence of communities on interior village and forest village are quite high and large diversity of products are gathered for household as well as commercial purpose. The diversity and financial value of the gathered products are varied in different forest type. In Darjeeling hill area the most likely scenario, will be the aggregate quantity of non timber product potentially available for extraction is likely to increase in the evergreen and semi evergreen forest areas and decline in area under comparatively low income yielding dry deciduous, dry thorn and montane forest areas.

There will be an increased income from potentially extractable non timber forest products with the income. The economy and livelihood of the people in Darjeeling hill areas are conditioned by the environmental conditions. Topography, climate and soil conditions have influenced human occupancies like agriculture, quarrying, trade and commerce and transportation the major livelihood of the local people.

Plantation economy (tea, cinchona and forest horticulture/floriculture) engages most people while agriculture, quarrying of stones for building and road construction work trade and commercial activities pertaining especially to tourism trade and transport media engage a sizeable proportion of people.

Forestry is an important occupation of the people of Darjeeling hill areas. The forest area in the hill has diminished considerably in recent years. Owing to a high rate of population increased the per capita agricultural and forest areas have shown a sharp decline. Demand for wood as industrial raw materials, fuel would led to indiscriminate cutting of valuable trees unless stringent monitoring is not implemented. Many forest industries have come up and there is huge potential for further development. Cultivation of aromatic medicine and exotic plants and orchid is a source of income in the regional economy. This conclusion is based on the assumption of equilibrium response of vegetation to environmental degradation and climate change.

However, there is uncertainty regarding the transient response of vegetation to climate change and this could lead to loss of vegetation. Conversely fuel wood and timber production may increase due to increase productivity as a result of increased carbon dioxide fertilization and nitrogen deposition.



**Table 5.1 List of endangered medicinal plants found in the Darjeeling hills**

No	Medicinal plants/ herbs			
	Local name	Botanical name	Parts of plant used	Mode of application
1	Nageswari	Lycopodium spp. Lycopodiaceae	Leaves, stem	Pounded and applied externally
2	NA	Pteridium polypodiaceae	Rhizome, fruits.	Drinking decoction of rhizome and fruits
3	Gopresala	Abies spp. Pineceae	Bark, leaves	Fumigation
4	Bojho	Acorus celamus Araceae	Roots, rhizome.	Pounded roots are administered orally. The rhizome are emetic, antispasmodic carminative, used in remittent fever and bronchitis and to cure cough and cold.
5	Kukurdaini	Smilax spp, Liliaceae	Stem	Brushing
6	NA	Hedychium sps Zinglberaceae	Rhizome	Pounded Rhizome administered orally
7	Chabak	Piper sps Piperaceae	leaves	Pounded Rhizome administered orally
8	Harchun	Viscum album Loranthaceae	Leaves	Leaf powder is applied externally decoction internally.
9	Pinse Jhar	Polygonum sps	Roots, rhizome	Root Juice for cough.
10	Tambarki	Stephania Menispermaceae	Leaves	Paste of leaves of the Plant is used in opening up of boils.
11	Basak	Diohora fabrifuga Sexifugaceae	Leaves, roots, shoots and bark	Decoction of pounded leaves for fever; roots for Malaria; young shoots and bark as febrifuge.
12	Kurakkeh	Astilbe rivulara	Roots	Decoction of roots.
13	Asilu	Rubus Elipticas	Roots	Decoction of roots.
14		Prinsopa utilia Araliceae	Leaves	Oil of the plant is used externally
15	Abijalo	Drymaria Cordata Caryophyllaceae	Leaves	Fumigation in case of headache, leaf, juice in case of fever.
16	Taki	Bauhinia Variegata Papilionaceae	Buds, bark, roots, flowers.	Dried buds for cough; bark is tonic, astringent; roots for dyspepsia and flatulence; flowers as mild laxatives.
17		Oxalis Cornicalata Oxalidaceae	Leaves	Leaf curry as appetizer and for treatment of dyspepsia, leaf juice applied on boils.

18	Tezbal	Zanthoxylum alatum Rutaceae	Fruits, branches, seeds bark	Fruits as anti-typhoid, seeds and bark as aromatic tonic in fever, dyspepsia and cholera.
19	Tooni	Cedrela toona Meliaceae	Bark	Decoction of bark as powerful astringent.
20	Bhalavo	Rhus succedanea Ancurdiaceae	leaves, fruits	Leaf used for indigestion and vomiting, fruits are denoted for prosthesis.
21	Bhalubans	Dendrocalamus Sikkimensis	Young shoots	Young shoots boiled and eaten
22	Tamabans Pou	Bambusa poaceae Bambusa arunurnaria Bambusa vulgaris	Buds, Shoots	The tender sprouting bud/shoots can either be eaten raw/fermented. In dried form it can be preserved Tama preparation, young shoots are cut into small pieces and boiled and drained.
23	Nigalo susha	Arundinaria falcota Arundinaria artistata Poaceae	Shoots	These two species are not used in Tama preparation but tender shoots are cooked and eaten.
24	Mailing Puthu	Arundinaria intermedia Poaceae	Stem	Stems are used for making straws for local drinks
25	Betfal Ru	Calamus erectus Arecaceae	Ripe Fruits	Ripe fruits are available in the end of February
26	Kebro	Ficus virens Moraceae	Young Shoots	Young shoots used in pickles
27	Sanulambu Mekrapekung	Morus australia Moraceae	Fruits	Ripe fruits available from April to May
28	Simzoo Surang	Utrica parviflora Utricaceae	leaves and flowering twigs	Leaves and flowering twigs are cooked as vegetable
29	Sishnu, Lekshishnu Surungyong	Utrica ardens Utricaceae Utrica dioca	Tender shoots, leaves	leaves and tender shoots are thoroughly boiled in order to remove stinging effect and cooked as vegetables.
30	Thotne Kandyee Pain	Polygonum molle Polygonaceae	Young shoots	Young shoots are cooked as vegetable
31	Jingaro Jaringle	Phylolacca acinasa Phytolaccaceae	Young leaves, twigs	cooked as Vegetables
32	Dalda sag	Portulaca clearacae Portulacaceae	Young shoots, leaves	cooked as Vegetables
33	Phunchey Phomkung Rajbriksh	Machilus edulis Lauraceae Cassia fistula	Fruits	Fruits are taken by pregnant women
34	Ratokairalo	Bauhinia purpurea	Buds, flowers,	Cooked as vegetables.

	Pangra Kulukprt	Caesal pimiaceae Entada pursaetha Mimosaceae	seeds.	
35	Simrayo	Nasturtium Tropaeolaceae	Young Shoot, leaves	Cooked as vegetables.
36	Nangryn pot Sidipot	Zanthoxylum Aeanthopodium	Fruits	Fruits are used as spice.
37	Lapsi, Silot	Melra dubia	Fruits	fruits are eaten
38	Simul Tarul	Manihot esculentus Euphorbiaceae	Tubers	Tubers, used in Kaza preparation after peeled and boiled.
39	Malinds	Elaeagnus conferts Elacagnaceae	Fruits	Fruits are edible.
40	Gurans	Rhododendron aroboreum	Flowers	Flowers are used in Pickle preparation.
41	Chiwari Yelkung	Aesandra sutyraceae Sapataceae	Fruits	Fruits are edible.
42	Brahmadahoi na	Eryngium foetium Umbelaferae	Leaves	Leaves are used in pickles
43	Ishkush	Sechium edule	Tubers	boiled tubers are eaten
44	Kaferbuk	Canna coccinia	Tubers	Sweet tubers eaten & cooked
45	Pkeebuk (Sikkim Lily)	NA	Tubers	Edible tuber, a rare species in Hee-Gyathang in Dzongu zone.

Many important medicinal plants have already been disappeared even before proper documentation. Thus environmental degradation could have a negative impact on the living standard of communities residing in the hill areas most probably in forest zones as sources of income. Thus there will be an overall decrease in income, although there might be an increase in income from cardamom and groom-stick. However, combined effects of environmental degradation and climate change or biotic pressure will aggravate shortage of timber fuel wood and fodder. The list of extinct/ endangered plants used for food and medicinal purpose in Darjeeling hill areas (used in aliments) are shown in table 5.1.

### 5.3.2 Social Consequences

The life styles of the people have been changed due to environmental degradation as the people have left the use organic manure. Now, they mostly use inorganic manure, pesticide which is partially poisoning all living being. Secondly, the transformation of a forest base has far reaching impacts on rural communities and the local economy. The contribution of forest to the local economy in Darjeeling hill area is very small. However, the role of

forest in day to day subsistence needs and some indirect benefit accruing to the agricultural sector is enormous. The factor responsible for social stratification in rural Nepalis of upper class in rural areas of Darjeeling differed drastically in their mobility and status symbols. In past days, the upper class people in Darjeeling were not only political and economic policy makers, but the de-facto rulers (especially in village level).

### **5.3.3 Political Consequences**

Politically, no awareness campaign and other information have so far been organized in Darjeeling hills even though the environmental degradation is increasing day by day. Consequently, the political organizations have not yet been made any manifesto and issue in this regard. They are busy to demand other thing keeping aloof the basic needs of the people. The matter of dried up of water sources extinction of different flora and fauna were already brought to the notice of those political party even then they have not drawn their attention towards these basic problem. It is neglected in this manner the damaged environment cannot be repaired under any circumstances. The medical, physical, social, economic problems are gradually mounting due to environmental degradation. Lack of employment and opportunity among the hill youths has becoming a social issue these days. Consequently, unadeted population growth in the hilly areas has threatening carrying capacity and slowly there shall be problem of shelter, food and clothes also.

### **5.4 Conclusion**

The land of Darjeeling hill areas along with water and plant resources are in a state of massive degradation. Forests are being denuded all over due to the need and greed of the people. The fuel and fodder needs for the increasing human and cattle population with hardly any viable alternatives to plant resources are depleting the forests and green cover at an alarming rate. Hill slopes are getting eroded, filling up the streams with silt eventually leading to floods during the monsoon. Water spring and streams the lifeline of hill communities which are dying especially during the non-monsoon dry periods. Ever increasing landslides are causing serious harms to the economy, society and the environment of the Darjeeling Himalaya. Of late, the very existence of the Hill Cart road the life-line of Darjeeling hill area is under threat and in fact it remains cut-off since August 2010. The condition of the other roads are also equally at stake. The increasing frequency and magnitude of landslides in Darjeeling hills is a matter of grave concern today that needs immediate and all out efforts to ameliorate the problem.

participate in what kind of programs and how to participate and implement the programs such as voluntary coercive participatory etc.

Steps needed for large scale people's participation for development promoters could be: "go to the people" live with them; learn from them; serve them; love them; play with them; start with what they know; build on what they have". These eight principles when applied are likely to give response to the promotion of a good economic development. The above may be considered as basic principles of people's participation. Various ministers and NGOs as well as other voluntary agencies have taken several steps to implement the above principles organization.

- Organizing symposia, workshops, seminars of NGOs at the grassroots level to create awareness among the stakeholders.
- Eco development camps by villagers, students, NGOs etc in various parts of the hill areas normally financed by Government departments.
- Initiating plant nurseries, trees plantation and after care
- Conducting training course in college, schools, training Institutions etc.
- Initiating group action for water harvesting and other soil and water conservation programs.
- Promotion of generation through various types of fencing such as bio- fencing, stone wall fencing, but mainly social fencing.

Though the environment cannot change, it is very much within the reach of man to create a social environment that is conducive to the overall development of people. The various social, cultural and economic conditions that go a great way to improve the quality of life of an individual and the community as a whole. Thus its very much possible to improve the quality of life and living of the socially backward communities by improving their social, cultural and economic conditions where education, health and hygiene must get the top priority on the social agenda as social security is equally important for the backward community.

A right social environment is, therefore what is needed to bring the backward communities in to the mainstream of society, so that all the communities may live in an overall social harmony where the local people will be involved in various environmental and social activities, often in collaboration with well-meaning NGO's.

## 5.5 References

1. Basu, S.R. & Sarkar, S. 1987; Ecosystem vis-a-vis landslide: a case study in Darjeeling Himalaya, *Proce. Impact of Development on Environment, Geog. Soc. India*, 2; 45-53.
2. Bhasin , M.K. 1984, Report on the project 'Impact of Human Activities on Ecosystem and vice-versa with reference to Sikkim Himalayas'. Department of Environment, Government of India , New Delhi, pp 63.
3. Bhasin ,M.K. & Bhasin Veena 1995; Sikkim Himalaya Ecology & Resources Development Kamla-Raj Enterprises 2273, Gali bari, New Delhi 110006. p 20-23.
4. Bose, Deb Kumar. 2004; *Essays on Environmental Economics*. K.P .Bagchi & Company, Calcutta 700012. p 43-53.
5. Dutta, K.K. 1966; Landslips in Darjeeling and neighboring hill slopes in June, 1950: *Bul. GSI,B(15)*, 7-30.
6. Ghosh, A.M.N. 1950; Observation of the landslides of the 11 and 12 June 1950, in the Darjeeling Himalaya, unpublished G.S.I. report.
7. Griesbach, G.L. 1899-1900; General Report, G.S.I.
8. Hooker, J.D. 1949; Notes Chiefly botanical made during an excursion from Darjeeling to Tonglo, a lofty mountain on the conifers of Sikkim and Nepal, *Journal Asiatic Soc. Bengal*, 18, 419-446.
9. Lal, R. 1983; Soil erosion in the humid tropic with particular reference agricultural land development and soil management, *IAHS Publication* 140, 221-239.
10. Negi G.S.S. 1994; High yielding vs traditional crop varieties: A Socio-agronomic study in a Himalayan Village in India, *Mountain Research and Development* 14 (3), 251-254.
11. Paul, D.K. 1973; Report on geotechnical investigation of hillslope stability and alignment of border road under project Swastik in Darjeeling district, W.B. and Sikkim, unpublished G.S.I. Report.
12. Roy, S. & Sen Sharma, S.B. 1967; Geological report on the stability of hill slopes in and around Darjeeling town, Darjeeling district, W.B. unpublished G.S.I. report.
13. Sarkar, S. 1999; Landslides in Darjeeling Himalaya, India; *Transactions, Japanese Geomorphological Union*, vol. 20-3, p.299-315.
14. Sharma B.D. and Ghosh, B 1971; Contribution to the flora of Sikkim Himalaya. *Bull. Bot. Soc. Bengal* 24, 45-55.
15. Sinha, B.N., Verma, R.S. & Paul, D.K. 1975; Landslides in Darjeeling district (W.B.) and adjacent areas, *Bul. G.S.I. B (36)* 1-45.

16. Smith W.W. 1911; Some addition to the flora of the Eastern Himalaya, Record, Botanical Survey of India, 4; 323-431.
17. Sondhi, V.P. et.al. 1966; Landslides and hill slope stability in the eastern Himalaya, Bul. G.S.I. B (15), 1-117.
18. Starkel, L. et. al. 2000; Rains Landslides and Floods in the Darjeeling Himalaya, INSA, New Delhi (ed), pp. 168.