

# **CHAPTER-10**

## **CONCLUDING REMARKS**

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#### 10.1. BIOTIC INTERFERENCES

Before the entry of man in the Darjeeling and Sikkim Himalayan parts of Eastern Himalaya, the vegetation of this region was mainly forested and was balancing well against the natural adversities including the biotic ones. This becomes clear when someone take enough risk with coverage to visit the vegetation in remote areas and are still maintaining without human-interferences. People entered in this area primarily through Tibetan and Burmese (i.e. Myanmar) region and secondarily from Indian plains in south. They gradually established their hutments in different localities and, with the increase of their population, the number of huts and hutments were increasing steadily in the part.

Along with the establishment of Royal capitals (at least in Sikkim and Bhutan) the city-based civilisation initiated there. Such type of civilisation also initiated in Darjeeling Hills with the establishment of a sanitorium by the then English ruler of India at Darjeeling for the treatment of sick English-Officers.

All such establishments and expansions took place with the cost of rich natural vegetation of the region. The expansion of civilisation generally cause multiferous harms to nature and there is no exception for the Darjeeling and Sikkim Himalayas. However, different types of biotic interferences can be classified as follows:

**I. Expansion of habitations:** As has already been mentioned human-habitations are now expanding at a very fast rate along with other related developments like the construction of metalled roads, dams, pipe-lines, tourist spots, sporting complexes, etc.

**II. Acquiring Land for cultivation:** For procuring enough food for ever increasing population man went on clearing forest from their surroundings and modified those areas into the crop-fields. Previously 'Jhum' method of cultivation was a common practice in this region which has also affected the vegetation.

**III. Grazing:** Grazing is a great threat for the natural vegetation in this area. Not only the local people graze their cows, goats and buffaloes but in high altitude there are migratory herds of yaks, sheep and cows. They move in different areas in Darjeeling, Sikkim, Nepal and Bhutan and in many places these are fixed routes for migration.

Along these routes, at many places, the excessive soil erosion due to hoof-bites lead to the creation of 2-3 m deep tunnels. These people also established numerous semi-temporary cow-shades along these routes.

The effect of such grazing destroyed natural vegetation, checked natural regeneration, caused land-slides and created vast areas of forced grassland specially in high altitude places above 2800m.

**IV. Fodder collection:** To maintain the domesticated animals, the non-migratory owners also collect quite a considerable amount of fodder. The collected fodder include a large variety of plants including herbs (including ferns), shrubs, climbers and trees. During the process of collection they also affect many other plants.

**V. Collection of Timber and Fire-wood:** Naturally, man was attracted vast store of timbers in the forests of this region. So, they collected timber indiscriminately leading to the destruction of forests. Man collected timbers not only of good quality (for the construction of houses and for furniture), they also collected lowly graded timber including the trunks of tree ferns and bamboos for different purpose. During timber extraction along with many plants climbing plants become badly affected.

**VI. Collection of NTFP:** Not only timbers are collected from forest, but a very large variety of 'Non-timber Forest Product (NTFP) are collected from these forests which include honey, various types of flowers, fruits, seeds, peculiar plant organs (e.g. the snake like stem of *Bauhinia scandens*) mushroom, etc. are regularly procured from forests.

Along with plants, huge amount of forest-floor humus is also collected for horticultural/ agricultural use or for plantation including tea.

**VII. Plantations:** After clearing the forested vegetation, plantations of different tree species was developed in wide areas. Previously those plantations were monoculture, i.e. with single species but not mixed plantations are being developed.

Monoculture of *Cryptomeria japonica* (Das and Lahiri 1997) led to the elimination of numerous local elements as the forest floor become deeply littered which decompose at a very slow rate. Plantations with other coniferous plants are also having nearly similar effects.

Darjeeling is also famous for its naturally flavoured tea. Tea plantations were developed here from terai upto an altitude of 2100m. Looking at the vast tea gardens across the horizons, one can easily imagine how much loss these have incurred to the biodiversity of the region.

Another plantation crop of this area is orange and these are also a large number of such orchards.

**VIII. Collection of Medicinal Plants:** Among the plant treasure of Eastern Himalaya, there are numerous medicinal plants. Most of these plants are never cultivated but the naturally growing plants are collected in high quantity. The list of such medicinal plants also include a number of climbers.

**IX. By Products of Tourism and Domestic litters:** Tourism is a major industry in Darjeeling and Sikkim. There are numerous trekking routes. Tourists throw away many of their rejected materials specially along with trekking routes-which pollute the nature. Similarly, there are numerous domestic rejects or refusals which are also interfering with natural phenomena.

**X. Automobile Pollution:** Along with the increase in habitable areas, roads links and development of tourism and other industries the number of automobiles on the road is increasing steadily. So, the effect of automobile pollution on local vegetation is increasing day by day.

**XI. Forest Fire:** It is one high humidity zone so the occurrence of natural fire is not known for this region. But, forest fires are quite common during drier months of the year and all these are man initiated-willingly or unwillingly. Fire from poachers oven, cigarett butts, etc. may be cause of such fires. People also initiated fire for killing trees (also forests), charing animals for hunting on are just for pleasure. Fire burns seeds and other propagules of plants, barks of trees, freshly gathered litter, etc. causing huge loss for the natural vegetation.

**XII. Introduction of Foreign Elements:** For our need and / or pleasure, we introduce many exotic plants, many of which got naturalised and some of them dominating in this area. Different species of *Cestrum*, *Eupatorium*, *Tithonia diversifolia*, etc. are common examples. These also responsible for driving away the local elements.

So, the biotic interferences, specially man-mediated, are very important factor for the change of vegetational structure and the loss of biodiversity from this part of the Himalayas which is also occupying a great part of a **Hot-spot-Zone** for conservation i.e. the Eastern Himalaya.

## **10.2 FURTHER SCOPE OF STUDIES:**

The present set of investigation on the angiospermic climbers of Darjeeling and Sikkim Himalayas has accumulated a considerable amount of data on their flora, habit, habitat mode of climbing, morphology of climbing organs, phenology,

palynology, cytology etc. has been accumulated. All these basic information might find their use in various ways including:

- (i) the determination of the mode of forestry operation
- (ii) determination of strategies for conservation of plants
- (iii) procuring and cultivating useful plants
- (iv) R/D studies on these plants to find out the utilisation of many of these plants
- (v) identified and verified specimen in the herbarium will of much help to the workers in allied branches to get their materials properly identified
- (vi) climbers introduced in the NBU Botanic garden can be further propagated and use by researchers from many other fields of studies
- (vii) the academic interest of the work is immense and the collected data can be used for the determination of phylogeny, classification of the habit group, development of mode of climbing, specialisation of climbing organ, etc.

### 10.3 CONCLUSION:

The record of 284 species of Angiospermic climbers from a recent survey in the Darjeeling and Sikkim part of Eastern Himalaya is expressing the richness in the representation of this special habit group of plants in the vegetation. Out of them there are 3 spp. endemic to Darjeeling and Sikkim Himalayas, 34 spp. endemic to Eastern Himalaya, 27 spp. endemic to Eastern Himalaya and North East India and 5 spp. endemic to the Himalayas. Quite a good proportion of these plants are also useful in various ways in different degrees.

Not only the external morphology, but the internal structure of tendril, the specialised structure of many climbing plants, also interesting and thought generating which need further detailed and critical studies to understand the cause and course of such modifications.

While all of these information are encouraging and interesting there are quite a few aspects which are causing concern about the survivability of many of these plants:

- (i) There are at least 129 spp. of angiospermic climbers, recorded earlier from this region but we are not found during the present survey; probably, most of these plants are now extinct (at least from this region!).

(ii) Among the presently recorded plants about 30 spp. have been seen at one or two places or just one or two individuals have been seen.

(iii) Due to the destruction and/or modification of natural habitat for many climber, it become increasingly difficult to get a suitable habitat for their normal growth.

(iv) Over-exploitation of some species and the clearing of others as 'useless plants creating disturbances in free movement inside the forest, etc. are also causing depletion to the population of many of these plants.

(v) There is no any systematic approach from any concern to look after on to monitor the conservation of the special but vulnerable habit group of higher plants.

During the present survey, attempts has been made to accumulate information about the climbing plants of Darjeeling and Sikkim Himalayas which might be used for further taxonomical analysis for this special group of plants.

The present strategies for the conservation of the natural vegetation of Darjeeling and Sikkim Himalayas are not sufficient to protect their originality. Unless, the present rate of human interferences are stopped or decrease, majority of these climbing angiosperms will be perished from this area within the next 2-3 decades.

The brighter side is that, Government is now becoming more and more interested to protecting the natural resources (including vegetable) of the country, and the new programmes are bringing the forests of larger areas under protection. But, much more things are to be done to save the vulnerable climbing wealth of Darjeeling and Sikkim Himalayas.