ABSTRACT

The sub-Himalayan North Bengal is endowed with many natural resource, of which "forest" is the most important. Being renewable resource, the forests are performing a number of functions including ecological, recreational and economic. The area is still blessed by 3037 sq.km. as forest which is 32.39% of the geographical area of the districts. The most remarkable feature of forest of Darjeeling and Jalpaiguri district is the wonderful variety of species that it contains. Few places in the country in which so many different types of forest exist within so small an area. Forest being green gold play an important role to boost up the local economy and maintain the ecological stability of this strategically important part of the country.

The region was under dense cover of natural vegetation 150 years back (estimated to be over 80% of the geographical area). Major portion of which had been cleared by the so called developmental processes during the British occupation. Extensive heedless deforestation invites soil erosion and inumerable landslides in the hilly parts and devastating floods in the foot hills and plains during the monsoon months. The forest based industries, which play a prominent role in the economic development of the study area are also showing a sign of stagnation. Unscientific and unplanned exploitation of forest resource have led to the establishment of vicious cycle of degradation and endangering the ecological balance of the area.

Geologically, the study area is composed of several types of rock formation of different characteristics. The northern hilly part is composed of highly metamorphosed rocks like gneiss, schists, phyllites, slates and quartzities. The foot hills tract is composed sandstones, siltstone, shall etc. The southern plains is composed of recent to sub-recent alluvium and fan materials.

Topographically, the area is divided into three distinctive segments. (i) the hills (ii) the piedmont and (iii) the plains. The hilly region is restricted within Darjeeling and extreme north-eastern part of Jalpaiguri district. The piedmont which is locally known as *terai* and *duars* includes the entire Siliguri sub-division of Darjeeling district and northern part of Jalpaiguri district. This is formed due to the coallescing of several alluvial fans with the catchment area of the Mahananda, Tista, Torsha, Sankosh, Raidak and Jaldhaka. The

plain region is located to the further south of Jalpaiguri. Perceptible gentle gradient of land is a significant feature of this region.

The study area is endowed with an intricate network of river systems. Most of the rivers are considered to be highly notorious for their unpredictable nature, letting loose fury of flood and problem of extensive and regular bank erosion, shifting course and render thousands homeless during rainy season. The majority of the rivers of *terai* and *duars* originate in the Himalayas to the north and northwest and flow along south to southeasterly direction.

Large latitudinal extent and physiographic variation of the area have brought diversity in climate with contrasts in meteorological conditions resulting in the development of greater degree of seasonality. Rainfall in the area follows the typical monsoon pattern. It occurs mostly during the four months from mid-May to mid-September. Many parts of the area enjoy a warm rainy season which is advantegeous for the growth of vegetation. Annual rainfall varies from 2,500 to 5,000 mm. The mean annual temperature ranges from 10 ^{0}C to the extreme north to 24^{0}C to the southern plain.

Forest of the study area performs some productive functions which can be achieved through the exploitation of forest. The local economy associated with it is called extractive economy. Assesment of forest resource is done on the basis of primary data collected from the fields and from multifarious secondary sources. The region is endowed with a variety of climate and edaphic conditions resulting in rich and varied flora. The distribution of forest is shown by geographical area, legal status and spatial distribution of forest land . The forest is classified into seven types which includes Sal forest of the plain, Reverine forest, West mixed Sal and Moist deciduous forest, Middle hill forest, Lower hill forest, Wet temperature montane forest and Alpine forest. Tree species are categorised into two types - General species which include timber bearing trees and Miscellaneous species indicate non-timber bearing trees. A total of 42 wood species are identified by the investigator and out of which 14 species are of economic important. Non-timber forest productsare Citronella oil, Sal leaves, Sal seeds, Mashroom, Turmeric, Medicinal plants, Khata etc. A picture of degradation of the forest of Darjeeling and Jalpaiguri district is also highlighted. Among the various reasons, the most important is the illegal felling. Other causes include landslide and soil erosion, flood induced river shifting and dolomite mining along Indo-Bhutanese

border. Total growing stock of timber is estimated 32787.69 (in thousand cu.m.) which is made from the several records of forest department. Annual growing stock of NTFPs is also prepared by the investigator through sample survey and secondary sources. The production of the forest of the area can be increased manifolds if proper management is followed and more inputs in the forms of quality multipliers i.e. seed, clone, graft, nutrients and irrigation can be provided.

The forest of Jalpaiguri and Darjeeling district is the store house of variety of major and minor products. The important forest products are wood and a number of non-timber forest produce. The forest based industries occupy a prominent place in the economy of Darjeeling and Jalpaiguri district. These industries are traditionally dependent upon forest and consume huge quantity of wood and provide employment opportunities to the rural population. There are large number of wood based industries in the area namely saw mills, veneer mills, ply wood, furniture, packing box etc. Some industries are also based on non-timber forest produce. The condition of forest based industries in the study area is not so bright due to the introduction of Forest Conservation Act. 1980, and National Forest Policy 1988, which severely restrict the clear felling of natural forests. So the major problem faced by the industries is the shortage of raw materials. Import of timber is also limited and costly. It is, therefore, imperatives that the effort be made for meeting the demands of these industries by growing trees outside the forest areas. Economically important trees should be planted. Three approaches are suggested which include **farm forestry or growing of trees by individual on their farm lands, strip plantation or growing of trees on strips along roads, cannels, river and the agro-forestry or inter-cropping culture.**

For analysis of marketing of timber, poles, small wood and fire wood, some market centres are selected to understand the marketing scenario of the area. The market centres are important because they provide lot of information to understand the trends in marketing of forest product of the districts as a whole. The bulk of forest product in the study area comes from government forest. Forest department supplies the major quantity of timber to the wood depots (40.8%). Sample survey reveals that Sal (43%) and Sissoo (14.5%) are the main species in the wood depots. There are some non-timber forest products which are marketed by the W.B.F.D.C. Ltd. The major market centres in the area are Siliguri,

Bagdogra, Alipurduar and Madarihat. Other than these local markets, a big secondary market existing in Kolkota. Various types of traders are involved in wood trading. Retailers are the major trader in the wood market. There is a wide variation in the price of wood due to quality, size and measurement. It is noted that Sal, Teak and Sirish are the premium species in view of annual growth rate of prices. Two type of buyer are involved in trading of wood (i) **Timber merchant both local and outsiders and (il) General users.** To make the marketing of forest product more effective, the state government should get into the marketing intelligence to enable it to monitor market price on weekly if not daily basis. A simple one page news bulletin may be issued indicating market location, market size, information, quality etc. Such news bulletin may be updated from time to time and broadcast or telecast through AIR/DD under "farmers" programme.

The study area possess a large variety of fauna from the largest Elephant (*Elephas maxima*) to the smallest Hogbadger. The high altitute of the Darjeeling Himalaya is the house of Red Panda (*Alurus fulgins*). Apart from this the Royal Bengal Tiger (*Panthera tigris*) and one horned Rhinoceros (*Rhinoceros unicornis*) are the important fauna of the area. Eco-tourism is developing with the exploitation of the natural resource including forest. The study area attract more than 40,000 nature lover tourists to the forest site every year. The ecological usefulness of forest of the study area is most readily observed in their beneficial effect on river catchment areas, where they have a regulatory influence on stream flows and protect soil from erosion. The occurrence of landslides are found much less in densely forested tracts in the study area. The virgin forest area which are practically landslide free zones. During the year 1998, 225 ha. of landslide affected areas have taken for plantation. The eastern part of the river Mahananda is still under dense forest cover and perhaps prevents the occurrences of major flood in the *terai* foot hills. On the contrary, occurrence of flood are found more frequent in degraded forest areas. The case study of soil erosion on the upper Mahananda basin clearly reveals that the rate of soil erosion is much less in densely forested tracts. Large scale afforestation programme at the government and private level is needed in the study area to improve the environmental quality. However, plantation of exotic species like Dhupi, Ecalyptus and Teak shuold be avoided as they have adverse affect on soil and water balance.

A picture of potential of various forest resource like timber including fuelwood and poles, non-timber forest produce, employment potential, wild life potential, tourism potential

etc. are taken into consideration. It is observed that the potential of timber, fuel wood and poles in the hilly region of the study area is more than that of plain areas. The northern hilly tract still posses a fair amount of natural forest with variety of species. The social forestry of the area has great potential to generate large number of employment. It would be possible to generate over 2 million mandays of employment among rural unskill workers. The case study of strip plantation of Madarihat-Falakata range proves the points that strip plantation if properly protected can generate a revenue of Rs. 2744.4 million in Jalpaiguri district alone within a period of 10 years rotation. Production and collection of NTFPs in the area involve huge number of employment to the forest villagers. Scientific exploitation of NTFPs can reduce the increasing pressure on natural forest. The study area has high potential to develop eco-tourism industry which can boostup the local economy. Eco-tourism has also employment potential. There are some National Parks, Tiger Reserve and Wild life Sanctuaries in the area which are the main attraction of the tourists. The forest of the districts has also ecological potential. Several case studies and field survey reveals that the forest may contribute largely towards moderation of flow of water in the catchment areas. They also offer protection against landslide, soil erosion and flood.

Few measures are adopted in the study area to conserve the valuable forest resource. These include Social Forestry, Joint Forest Management and Agro-forestry or Inter-cropping. The **Social Forestry** plantation have not been able to take the pressure of natural forests of Darjeeling and Jalpaiguri district. Strip plantation in Madarihat and Falakata Blocks have generated good amount of revenue to the local panchayat but the adjoining forests of Jaldapara sanctuary, Kurseong and Siliguri division continue to be disturbed. The strip plantation are also prone to theft, damage, fire, grazing and encroachment and therefore, not much timber and firewood remains available at the time of harvesting to meet the local demand fully. At the village level a **Strip Plantation Committee** consisting of local villagers and the Panchayat should be formed to protect the plantation of social forestry. This joint collaboration between forest and local people will improve the production of social forestry to a very great extent and would also generate huge surplus revenue for Panchayat to attain self sufficiency apart from meeting the raw material need of local wood based industries thereby supplementing employment opportunities for local population. There is, however, a need for change in the infrastructural set up and administrative guidelines to ahieve the desired results. Another important measure which is adopted in the

area is the introduction of **Joint Forest Management** through the establishment of FPC/ EDC by the forest department. The forest department has apparently failed to interact with these committees on a regular basis. It is correct to mention that the share of people i.e. FPC, in the final harvest varies. In the districts, FPCs are entitled for 25% whereas in Gujrat it is 50% of the net sale proceeds. The forest department should provide more incentives to participate in JFM. For successful implementation of the JFM in the study area, micro-planning of individual FPC/ EDC area is most essential. The third measure is the **Agro-forestry or Inter-cropping culture.** This practise has not developed to a great extent but the overall performance of inter-cropping practice in the study area is good. Kurseong forest division has occupied a significant place in inter-cropping.

Thus it is apparent that forest resource of the Darjeeling and Jalpaiguri district which play an important role in the economic development of the region should be managed properly. Three dimensions are suggested by the investigator for the forest resource management imperatives. The first approach is **Management of protecting the existing forest resource** through the application of modern silviculture practice . The next imperative is the **Scientific management of social forestry** and others. Under this approach, more stress should be given in the villagers participation in forestry programme. It is observed that the government policy will not be able to protect the valuable forest resource unless local people are motivated systematically. If villagers are given proper incentives for farm forestry, it would not only result in greater awarness but would also generate more employment and income at the village level. The third dimension of the forest resource management is the **management of natural, cultural and economic environment of forest.** Natural imperatives highlights management of soil environment, slope failure and landslide affected forest areas of Darjeeling Himalaya. Cultural aspect focuses on population management and more research work on forest. There are some sectors or departments in the area which have close linkage with the forest department. These sector include land revenue department, agricultural department, tribal welfare department , animal resource development, local Panchayat, local university etc. The policy of forest department and other linkage sectors should be properly linked. It will bring a bright future of the forest of the area. Economic environment of forest indicates the management of forest based industries. At present the most serious problem is the lack of supply of raw materials to the local forest based industries due to the imposition of restriction on clear felling by the

government. It is suggested that the forest based industry should raise the raw material needed for meeting its own requirements, preferably by the establishment of a direct relationship between the factory and the individuals who can grow the raw material by supporting the individuals with inputs including credit, constant technical advice and finally harvesting and transport services. Economic management of forest will certainly beautify the hilly landscape of Darjeeling and *duars* region of Jalpaiguri district, which will also help to promote eco-tourism industry. In addition, a **District Ecology Council** should be set up under the chairmanship of leading ecologist to decide the future course of development and forestry in the area. With these views, it is expected that if proper attention and methods of utilisation are adopted, the study area will be richer in forest resource which will ultimately provide environmental and economic development.