

# **CHAPTER V**

## **VEGETATION**

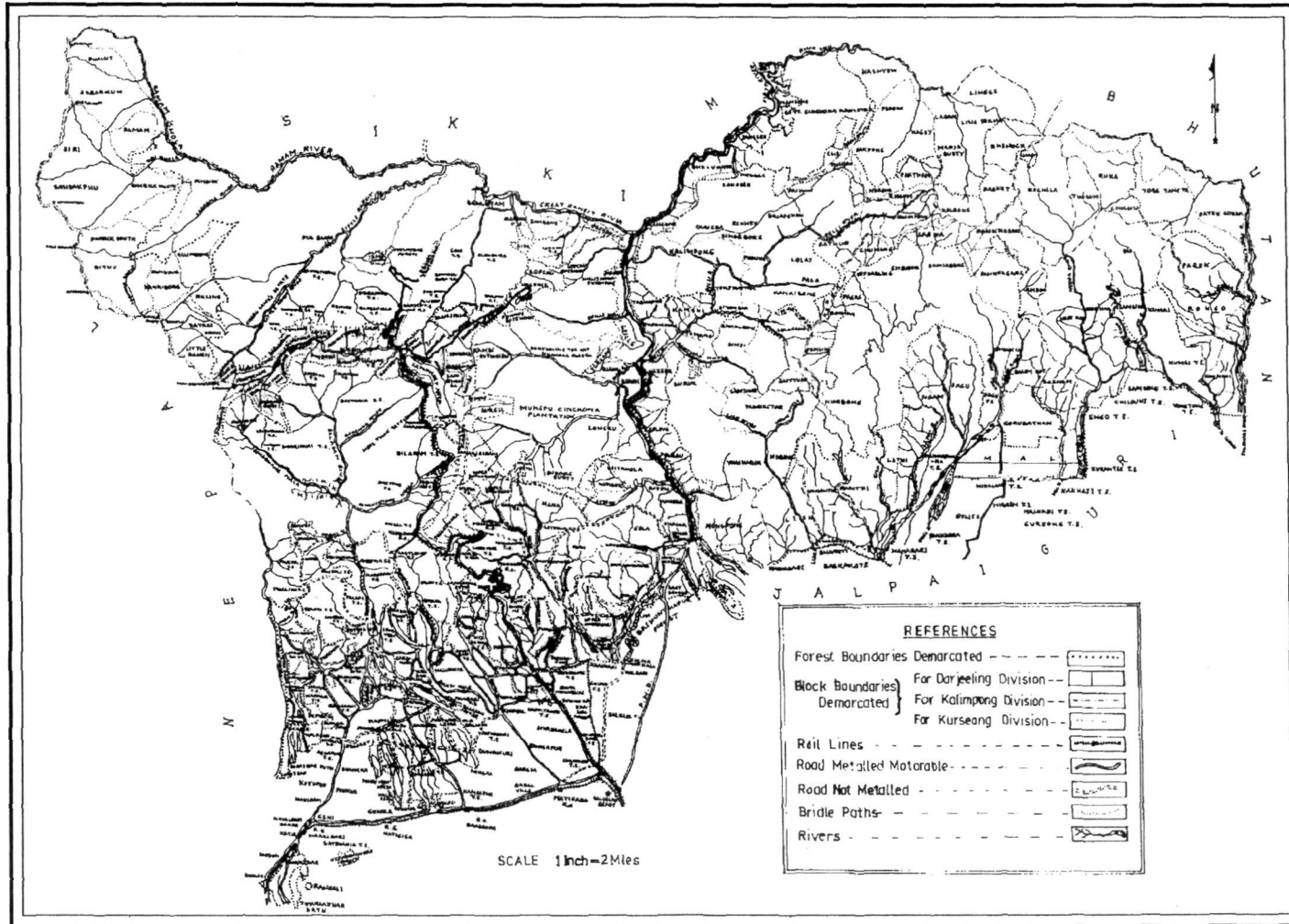
### **5.1. FOREST BIODATA**

The district of Darjeeling covers 3.68 percent of the geographical areas of West Bengal state. Most of the hill areas of Darjeeling and Kurseong sub divisions are covered by the tea plantation. At present there are 87 tea estates in the district (Census of India 1991). Kalimpong sub division is an exception with the major part under agriculture and cultivation although a few tea estates are present on its south-eastern part. The profile of land use pattern in these three hill sub division is as follows.

Total geographical area	:	2417.3 sq.km.
Forest area	:	1203.06 sq.km.
Agriculture area	:	371.00 sq.km.
Areas under the cultivation of medicinal plants	:	50.00 sq.km.
Forest areas degraded by soil erosion	:	382.63 sq.km.
Land areas degraded by soil erosion	:	470.00 sq.km.

The Siliguri sub division with a geographical area of 837.4 sq.km does not have any accountable forest area. 37.42 % of the area is under forest cover in the district of Darjeeling (including Siliguri sub division), where the state of West Bengal as a whole has 13.4% of such an area. As per the prescription of national forest policy of India, a hill region must invariably have at least 60 % of its geographical area under the forest cover. The census figures of the past several decennial periods show that the total forest area of the region has been steadily on the decline. The recent surveys however, indicate that the area under the actual forest cover in the district is below 35 % (Bhujel 1996).

Map - 5 FOREST DIVISIONS OF DARJEELING DISTRICT



## 5.2. FOREST DIVISIONS AND MANAGEMENT

Many of the forest areas of the Darjeeling district in the past were changed into tea estates. Under the wildlife protection act and Indian forest act XVI of 1927, the forests of Darjeeling were subsequently notified as the protected forest, reserve forest, national park and wildlife sanctuaries, suggesting the conservation of forest resources. On the administrative ground, under the government of West Bengal, the forest of Darjeeling (Map-5) has been divided into three forest divisions (Table-5.2.1). The plain region of Siliguri sub division does not have such a forest sub division. Among the three hill sub divisions, Kalimpong occupies the largest forest cover. There are 90 forest sub divisions in the district (Census of India 1991). The forests of Darjeeling hill region have been categorized into reserve forests, protected forests and unclassified state forests (Darjeeling Gorkha Hill Council Forest). The respective areas of the forest cover are tabulated below.

Table:5.2.1. Forest type in Darjeeling.

Forest Division	Reserve Forest (sq.km)	Protected Forest (sq.km)	Unclassified areas (sq.km)	Total areas Forest villages	No.of
1. Darjeeling	295.17	13.34	1.9	310.41	36
2. Kalimpong	582.59	1.15	7.5	591.31	29
3. Kurseong	290.63	2.4	8.3	301.33	26
Total	1168.4	16.89	17.7	1203.06	91

Both the reserve and protected forests are constituted from the forestland or wasteland on which the government has proprietary right. The principal objective of such forests is to protect the biological resources. The unclassified state forest is a forest resumed from the private ownerships by the forest department. A major portion of the unclassified forests in Darjeeling is now under the jurisdiction of the Darjeeling Gorkha Hill Council. However, due to the lack of adequate infrastructure the protection measures in these forests have not been stringent.

## 5.3. NATIONAL PARKS AND WILD LIFE SANCTUARIES

There are two national parks and three wildlife sanctuaries in the district covering an area of 364.66 sq.km.

National parks :         •         Singalila national park (Darjeeling division)

- Neora valley national park (Kalimpong division)
- Wildlife sanctuaries • Senchel wildlife sanctuary (Darjeeling division)
- Jorepokhari–salamender wildlife sanctuary (Darjeeling division)
- Mahananda wildlife sanctuary (Kurseong division)

### **Singalila national park**

The national park was declared in 1992 and covers an area of 108.7 sq.km with a core zone of 78.6 sq.km. The remaining 30.17 sq.km area is the buffer zone. The park is separated from Sikkim by the river Rabongla khola in the north, and by a motorable road which acts as the boundary to separate it from Nepal in the south-west. The national park on the eastern side is marked from Maneybhangyang (2150m). The geographical elevations of the core zone range from 2400-3636m. The park harbours a small, naked sub alpine zone at its highest elevation (PI-12). There are six beats namely 1. Gairibas, 2. Kalpokhari, 3. Sandakphu, 4. Sabargam, 5. Phalut and 6. Ramam ranging from 2624-3636m altitudes. A number of human settlements are found (mainly Bhutia, Sherpa and Nepali) in and around the national park (*i.e* Indo-Nepal boarder). These settlement areas are namely Chitre (2450m), Meghma (Phatak-2992m), Tumling (2949m), Jaunbari (2900m), Gairibas (2625m), Kaiyakatta (2879m), Batasay (2971m), Kalpokhari (3100m), Bikheybhangyang (3200m) and Sandakphu (3636m). Other settlements on the north-eastern side surrounding the park are Samanden (2500m PI-19), Ramam (2300m), Sirikhola (2200m), Gurdung (2300m), Gorkhey (2380m), Namla, Phedi, Upper Rimbick and Rimbick bazaar (2000m). Gorkhey is the only forest village within the core zone of national park. Besides, there are number of tourist huts and bungalows under the Darjeling Gorkha Hill Council, situated at Tonglu (3070m), Gairibas (2625m), Sandakphu (3636m), Moley (3300m), Phalut (3600m PI-18), Gorkhey (2380m), Ramam (2300m) and Sirikhola (2100m). However, no permanent settlements are found at Tonglu, Moley and Phalut.

### **Neora valley national park**

Covered by the oldest reserve forests (PI-15) this was declared as a national park in 1986, which occupies an area of 88 sq.km. The boundaries of Sikkim and Bhutan meet at this park at Rachela (3150m) forming a trijunction while its southern boundary meets the district of Jalpaiguri. There are four beats namely 1. Rachela (Rechila), 2. Thosum, 3. West Ner and 4. East Ner ranging from 500-3150m altitudes. Rachela chak is a settlement area of 3 hectares inside the national park.

## **Senchel wildlife sanctuary**

It is located in Darjeeling sub division in the southward extension of Singalila range. Established in 1940, it is one of the oldest sanctuary and covers an area of 38.88 sq.km with different elevations ranging from 1067m to 2600m. The sanctuary area has a giant reservoir which collects water from perennial springs (*Jhora*) and rain fed streams for supplying the drinking water to Darjeeling town, and its adjoining areas. The eastern part of the sanctuary is bounded by the Cinchona plantation where northeastern and small portion of the south-western parts are bound by the tea estates while southern portion of the sanctuary is surrounded by *khasmal* (settlements) areas. There are five beats namely 1. Sixth mile, 2. Third mile (Simkuna), 3. Jore bungalow, 4. Sonada and 5. Rambhi.

## **Mahananda wildlife sanctuary**

Located in Kurseong sub division, it was reserved forest until 1976. From the west bank of river Teesta, it occupies an area of 129.04 sq.km spreading over both in terai and the hills. The elevations range from 200-1000m. There are nine beats namely 1. Kalijhora, 2. Latpanjar, 3. Punding, 4. Sukuna, 5. Gulma, 6. Toribari, 7. Sevoke, 8. Seventh mile and 9. Laltong.

## **Jorepokhari-salamander wildlife sanctuary**

The sanctuary is situated at Sukiapokhari, 28 km away from the Darjeeling town. It covers an area of 4 hectare and has a small lake at an altitude of 2300m. It was declared a wildlife sanctuary in 1985 to provide the necessary protection to *Tylotriton verrucosus* a rare amphibian that occurs sporadically in marshy hills of Darjeeling district. This species is protected in India under the schedule 2 of the wildlife protection act 1972.

## **5.4 GENERAL VEGETATION AND FOREST TYPES**

The vegetation and forest types of this region differ from its neighbouring regions of the eastern Himalayas when considered from the viewpoint of its rich biodiversity and distribution within the limit of this region. It is because of the great diversities in physiographic, climatic and edaphic conditions often aided by the biotic factors (Bhujel 1996). A comprehensive travelogue through the dense and magnificent forest and vegetation of this region is rather difficult to conceive due to the nature of Himalayan terrain and intricacy of the plant cover comparable to almost that of the tropical rainforest in some of the river valleys (Bhattacharya 1997). The physiographic

configuration of the hills and valleys, the slopes facing different directions and the altitudinal ranges are generally effected by the distribution of rainfall, wind velocity, and have the great role in the determination of the vegetation types. The areas having an annual rainfall above 500cm developed the moist temperate vegetation characterized by the trees with densely clad mosses, lichens, epiphytes and climbers.

The composition and distribution of vegetation is also determined by the variations corresponding to the altitudes, which range from as low as 150m at Siliguri to 3636m at Sandakphu. On further extension to 3800m at Gosa (west Sikkim boarder) this Himalaya enters the great mountain system of Mt. Kanchandzonga (8598m), the third highest peak of the world.

Attempts have been made to classify the vegetation of this region throughly in time to time by Gamble, J.S (1875), Hooker, J.D (1906), Cowan, A.M and Cowan, J.M (1929), Champion, H.G (1936), and Kanai, Hiroo (1966). However, these authors variously considered the mode of classification according to the altitudinal ranges. After a long gap of three decades, Chauhan, A.S (1996) and Bhattacharya, S (1997) made the general outline of classification of the entire flora and vegetation with few modifications. But in the line of classification and modifications, the determining factors such as climate and altitude and its impacts on the regional vegetation, should be considered (Bhujel, 1996).

Based on the floristic composition and distribution observed during the repeated field visits and excursions, the vegetations are classified under the following five categories (Bhujel 1996).

No.	Vegetation types	Altitudinal ranges
1.	Plain & tropical	Plains to 300m (-500m)
2.	Sub tropical	500-1200m
3.	Sub temperate	1200-1850m
4.	Temperate	1850-3200m (-3500m)
5.	Sub alpine	3200-3636m (-3800m)

### **1. Plain and tropical vegetation 300m (-500m)**

This type of vegetation is distributed to an altitudinal range of 500m where the annual rainfall is 150-200cm. It is characterized by the deciduous forest of pristine or manmade plantation. This can be further sub divided :

- a. Riverain forest
- b. Sal-teak forest
- c. Dry mixed forest
- d. Wet mixed forest
- e. Grass lands

**a. Riverain forest-** This type of forest can be observed in the small patches along the river banks of Balasan, Chel, Gish, Jaldhaka, Mahanadi, Mechi, Rangit, Relli and Teesta. The common shrub and tree species are *Acacia catechu*, *Acacia pinnata*, *Albizia lebbeck*, *Albizia procera*, *Cassia fistula*, *Cassia tora*, *Clerodendrum viscosum*, *Croton bonplandianus*, *Croton caudatus*, *Lagerstroemia hirsuta* and *Pandanus nepalensis*. The common climbers are *Dioscorea composita*, *Dioscorea glabra*, *Dioscorea pentaphylla*, and *Mikania scandens*.

**b. Sal-teak forest-** The forest of this category *Shorea robusta* and *Dalbergia sisso* are the predominating trees found in the Bhabar belt and well drained sandy soil. Preferred for its valuable timber, it is planted by the department of forest in association with *Anthocephalus cadamba*, *Chukrasia tabularis*, *Combretum decandrum* and *Dillenia pentagyna*.

This type of forest is well flourished along the valleys of river Teesta and Rangit up to the southern boarder of Sikkim, and from the eastern part of river Teesta to the banks of river Jaldhaka to its Bhutan boarder

**c. Dry-mixed forest-** This type of forest is represented by deciduous to semi evergreen species of *Acrocarpus fraxinifolius*, *Artocarpus lacucha*, *Bombax ceiba*, *Clerodendrum japonicum*, *Clerodendrum viscosum*, *Erythrina stricta*, *Gmelina arborea*, *Leea guineensis* and *Sterculia villosa*.

**d. Wet-mixed forest-** This type of forest is represented by semi evergreen to evergreen species of *Cinnamomum glaucescens*, *Cinnamomum bejolghota*, *Duabanga grandiflora*, *Litsea monopetala*, *Syzygium formosum*, *Terminalia alata* and *Terminalia myriocarpa*.

**e. Grassland vegetation-** This type of vegetation is represented by some woody grasses along the banks of river Balasan, Jaldhaka, Mahanadi, Rangit and Teesta. The dominating species are *Cymbopogon nardus*, *Neyraudiana aurandinaceca*, *Saccharum arundinecum*, *Saccharum spontaneum*. The other herbaceous members found are *Ageratum conyzoides*, *Chromolaena odorata*, *Argyreia roxburghi* and *Pouzolzia zeylanica*.

## 2. Sub tropical vegetation (500-1200m)

Generally effected by the seasonal climate of dry winter and wet monsoon, the forests are greatly of deciduous type (Grierson & Long 1983). This type of forest is found in the valley of river Balasan, Chel, Gish, Jaldhaka, Neora, Rambh, Rangit, Riyang and Teesta. The dominating tree members are the *Baccaurea ramiflora*, *Betula cylindrica*, *Callicarpa arborea*, *Castanopsis indica*, *Diploknema butyracea* *Dendrocalamus hamiltonii*, *Ficus semicordata*, *Gynocardia odorata*, *Mallotus philippensis*, *Phoebe lanceolata*, *Schema wallichii*, *Terminalia bellirica*, *Terminalia chebula*, *Toona ciliata* and *Zanthoxylum nitidum*.

The dominating shrubs are *Ageratina adenophora*, *Boehmeria glomerulifera*, *Calotropis gigantea*, *Chromolaena odorata*, *Costus speciosus*, *Croton caudatus*, *Combretum decandrum*, *Datura suaveolens*, *Holmskioldia sanguinea*, *Lantana camera*, *Leea macrophylla*, *Leea guineensis*, *Melastoma normale*, *Mussaenda macrophylla*, *Phlogacanthus thyriformis*, *Pouzolzia sanguinea*, *Premna scandens*, *Solanum myriacanthum*, *Solanum torvum*, *Thysanolaena latifolia*, *Toddalia asiatica* and *Vitex negundo*.

The climbers are *Ampelocissus barbata*, *Cissampelos pareira*, *Dioscorea hamiltoni*, *Dioscorea pentaphylla*, *Dittoceras andersoni*, *Entada rheedi* var. *sinohimalensis*, *Millettia pachycarpa*, *Mucuna pruriens*, *Stephania japonica*, *Stephania glabra* and *Tinospora cordifolia*.

The herbs are *Ageratina adenophora*, *Ageratum conyzoides*, *Bidens pilosa*, *Hydrocotyl asiatica*, *Lindenbergia grandiflora* and *Pouzolzia zeylanica*. Besides some of the cultivated species of trees are *Citrus auranticum*, *Citrus maxima*, *Citrus medica*, *Citrus reticulata*, *Cyphomendra betacea*, *Mangifera sylvatica*, *Psidium guajava* and *Punica granatum*.



### 3. Sub temperate vegetation (1200-1850m)

A short zone between 1200-1850m represents a different type of vegetation which are located as the small pocket at the places of Rambli forest, Takdah-Peshok, Algarah-Pedong, Kafer-Nimbong and Simana-Mirik. The dominating shrub and tree members are *Brassiopsis hainla*, *Buddleja asiatica*, *Daphne sureil*, *Dichroa febrifuga*, *Edgeworthia gardneri*, *Elaeocarpus lanceifolia*, *Engelhardia spicata* var. *acerifolia*, *Leucosceptum canum*, *Macaranga indica*, *Maesa chisia*, *Mussaenda treutleri*, *Osbeckia nutans*, *Osbeckia stellata* var. *crinita*, *Ostodes paniculata*, *Oxyspora paniculata* and *Vaccinium vacciniaceum*.

The climbing members are *Dicentra scandens*, *Holboellia latifolia* var. *angustifolia*, *Tetrastigma rumicispermum*, *Tricosanthes wallichiana*, and *Vitis heyneana*.

The plantation tree species are *Alnus nepalensis*, *Cryotomeria japonica*, *Exbucklandia populnea*, *Michelia doltsopa* and *Michelia velutina*.

### 4. Temperate vegetation (1850-3200m)

This type of vegetation is truly represented by the evergreen forest of closed canopy along with the deciduous tree members. The large and old trees are festooned with mosses, ferns, epiphytes and few parasites. On gradual increased of altitudes also influence the pattern of succession and its composition. Due to the greater altitudinal variations and huge number of floristic elements occurring in this zone, it can be further classify under the following sub types in accordance to Kanai (1966) and Grierson and Long (1983).

- a. Temperate deciduous forest
- b. Evergreen-Oak forest
- c. Hemlock-Rhododendron forest

**a. Temperate deciduous forest-** It is characterized by the presence of *Acer cambellii*, *Acer sterculiaceum*, *Alnus nepalensis*, *Betula alnoides*, *Castanopsis hystrix*, *Elaeocarpus lanceifolia*, *Exbucklandia populnea*, *Lindera neesiana*, *Lyonia ovalifolia*, *Lindera pulcherrima*, *Magnolia cambellii*, *Michelia doltsopa*, *Pentapanax fragrans*, *Persea fructifera*, *Rhododendron arboreum* and *Rhododendron grande*.

**b. Evergreen-Oak forest-** This type of forest is characterized by the species like *Acer thomsoni*, *Acer hookeri*, *Cinnamomum impressinerium*, *Elsholtzia fruticosa*, *Gamblea ciliata*, *Juglans regia*, *Lithocarpus pachyphyllus*, *Rhododendron falconeri* and *Quercus lamellosa*.

The under growth shrubs are *Aconogonum molle*, *Agapetes hookeri*, *Arundinaia maling*, *Astilbe rivularis*, *Daphne bholua*, *Dichroa febrifuga*, *Eurya cerasifolia*, *Helwingia himalaica*, *Rubus acuminatus*, *Rubus lineatus*, *Rubus paniculatus*, *Vaccinium vaccinoides*, *Viburnum erubescens* and *Zanthoxylum oxyphyllum*.

Within this sub type vegetation the climbing members are represented by the species of *Clematis acuminata*, *Clematis buchananiana*, *Clematis grewiiflora*, *Clematis montana*, *Dicentra lichiangensis*, *Dicentra scandens*, *Edgaria darjeelingensis*, *Holboellia latifolia*, *Mucuna macrocarpa*, *Smilax lanceifolia*, *Thunbergia lutea*, *Tricosanthes lepiniana* and *Vitex heyneana*.

The ground mass is covered by the herbaceous members of *Carex cruciata* var. *argecarpa*, *Clinopodium umbrosum*, *Cyperus rotundus*, *Fragaria vesca*, *Potentilla lineata*, *Ophiopogon wallichii* and *Viola thomsonii*.

**c. Hemlock (*Tsuga dumosa*) - Rhododendron forest-** A distinct uppermost canopy layer apart from the former two sub types characterises this sub type vegetation. The shrub and tree members represented by the members of *Abies densa*, *Arundinaria griffithiana*, *Betula utilis*, *Cotoneaster microphyllus*, *Daphne bholua* var. *gracialis*, *Hypericum hookerianum*, *Neillia rubiflora*, *Rhododendron arboreum* var. *roseum*, *Rhododendron barbatum*, *Rosa sericea*, *Rubus pentagonus* and *Tsuga dumosa*.

The ground cover is represented by the herbaceous members of *Aconitum spicatum*, *Gentiana capitata*, *Hemiphragma heterophylla*, *Meconopsis nepalensis*, *Primula denticulata*, *Primula listeri*, *Swertia bimaculata* and *Swertia nervosa*.

## **5. Sub alpine vegetation (3200-3800m)**

The upper most region of the Darjeeling Himalaya ranging between 3200 to 3800m (3636m) characterises the sub alpine vegetation of dwarf and stunted habit of flora. The Sandakphu-Phalut ridge extending to Gosa (3800m) display the sub alpine meadow of conspicuous vegetation. This type of vegetation is characterized by the dwarf shrubs and tree members of *Abies densa*, *Arundinaria maling*, *Berberis angulosa*, *Berberis hookeri*, *Cotoneaster sandakphuensis*, *Gaultheria trichophylla*, *Ilex intricata*, *Juniperus recurva*, *Lyonia ovalifolia*, *Rhododendron anthopogon*, *Rhododendron campanulatum*, *Rhododendron cinnabarium*, *Rhododendron hodgsonii*, *Rhododendron setosum* and *Rheum acuminatum*.

The herbaceous members found in the meadow and forest are *Allium wallichii*, *Anemone demissa*, *Gentiana bryoides*, *Geranium polyanthes*, *Geum sikkimense*, *Impatiens kingii*, *Meconopsis nepaulensis*, *Phlomis macrophylla*, *Pilea racemosa*, *Potentilla abruscula*, *Primula sikkimensis*, *Satyrium nepalensis* and *Saxifraga hispidula*.

## 6. Plantation forest

The department of forest, Govt. of West Bengal and Darjeeling Gorkha Hill Council have developed several patches of forest in selected areas under afforestation programme, forestry programme and social forestry programme. The major forest consist of *Albizia lebbeck*, *Alnus nepalensis*, *Betula alnoides*, *Betula cylindrostachya*, *Castanopsis hystrix*, *Castanopsis indica*, *Chukrasia tabularis*, *Cryptomeria japonica*, *Cupressus corneyana*, *Dalbergia sissoo*, *Eucalyptus globulosus*, *Exbucklandia populnea*, *Gmelina arborea*, *Juglans regia*, *Macaranga indica*, *Michelia champaca*, *Michelia doltsopa*, *Ostodes paniculata*, *Pinus roxburghii*, *Quercus acuminata*, *Schima wallichii*, *Shorea robusta*, *Tectona grandis*, *Terminalia alata*, *Terminalia myriocarpa*, *Thuja orientalis* and *Toona ciliata*.

Besides the major plantation of tea and cinchona, other minor plantations of large cardamom (*Amomum subulatum*), Lemon grass (*Cymbopogon nardus*), *Dendrocalamus hamiltonii*, *Edgeworthia gardneri* and *Thysanolenia latifolia* also found in the region.