Natural vegetation refers to a plant community that has been left undisturbed over a long time. So as to allow its individual species to adjust themselves to climate and soil conditions as fully as possible.

India is a land of great variety of natural vegetation. Himalayan heights are marked with temperate vegetation; the Western Ghats and the Andaman Nicobar Islands have tropical rain forests, the deltaic regions have tropical forests and mangroves; the desert and semi desert areas of Rajasthan are known for cacti, a wide variety of bushes and thorny vegetation. Depending upon the variations in the climate and the soil, the vegetation of India changes from one region to another.

On the basis of certain common features such as predominant vegetation type and climatic regions, Indian forests can be divided into the following groups:

**Types of Forests**

(i) Tropical Evergreen and Semi Evergreen forests

(ii) Tropical Deciduous forests

(iii) Tropical Thorn forests

(iv) Montane forests

(v) Littoral and Swamp forests.

**Tropical Evergreen and Semi Evergreen Forests**

These forests are found in the western slope of the Western Ghats, hills of the northeastern region and the Andaman and Nicobar Islands. They are found in warm and humid areas with an annual precipitation of over 200 cm and mean annual temperature above 22°C.

Tropical evergreen forests are well stratified, with layers closer to the ground and are covered with shrubs and creepers, with short structured trees followed by tall variety of trees. In these forests, trees reach great heights up to 60 m or above. There is no definite time for trees to shed their leaves, flowering and fruition. As such these forests appear green all the year round. Species found in these forests include rosewood, mahogany, aini, ebony, etc.

The semi evergreen forests are found in the less rainy parts of these regions. Such forests have a mixture of evergreen and moist deciduous trees. The under growing climbers provide an evergreen character to these forests. Main species are white cedar, hillock and kail.

The British were aware of the economic value of the forests in India, hence, large scale exploitation of these forests was started. The structure of forests was also changed. The oak forests in Garhwal and Kumaon were replaced by pine (chirs) which was needed to lay railway lines. Forests were also cleared for introducing plantations of tea, rubber and coffee. The British also used timber of construction activities as it acts as an insulator of heat. The protective use of forests was, thus, replaced by commercial use.

**Tropical Deciduous Forests**

These are the most widespread forests in India. They are also called the monsoon forests. They spread over regions which receive rainfall between 70-200 cm. On the basis of the availability of water, these forests are further divided into moist and dry deciduous.

The Moist deciduous forests are more pronounced in the regions which record rainfall between 100-200 cm. These forests are found in the northeastern states along the foothills of Himalayas, eastern slopes of the Western Ghats and Orissa. Teak, sal, shisham, hurra, mahua, amla, semul, kusum and sandalwood etc. are the main species of these forests.

Dry deciduous forest covers vast areas of the country, where rainfall ranges between 70-100 cm.
On the wetter margins, it has a transition to the moist deciduous, while on the drier margins to thorn forests. These forests are found in rainier areas of the Peninsula and the plains of Uttar Pradesh and Bihar. In the higher rainfall regions of the Peninsular plateau and the northern Indian plain, these forests have a parkland landscape with open stretches in which teak and other trees interspersed with patches of grass are common. As the dry season begins, the trees shed their leaves completely and the forest appears like a vast grassland with naked trees all around Tendu, palas, amaltas, bel, khair, axlewood, etc. are the common trees of these forests. In the western and southern part of Rajasthan, vegetation cover is very scanty due to low rainfall and overgrazing.

**Tropical Thorn Forests**

Tropical thorn forests occur in the areas which receive rainfall less than 50 cm. These consist of a variety of grasses and shrubs. It includes semi-arid areas of south west Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh and Uttar Pradesh. In these forests, plants remain leafless for most part of the year and give an expression of scrub vegetation. Important species found are babool, ber, and wild date palm, khair, neem, khejri, palas, etc. Tussocky grass grows up to a height of 2 m as the under growth.

**Montane Forests**

In mountainous areas, the decrease in temperature with increasing altitude leads to a corresponding change in natural vegetation. Mountain forests can be classified into two types, the northern mountain forests and the southern mountain forests.

The Himalayan ranges show a succession of vegetation from the tropical to the tundra, which change in with the altitude. Deciduous forests are found in the foothills of the Himalayas. It is succeeded by the wet temperate type of forests between an altitudes of 1,000-2,000 m. In the higher hill ranges of northeastern India, hilly areas of West Bengal and Uttaranchal, evergreen broad leaf trees such as oak and chestnut are predominant. Between 1,500-1,750 m, pine forests are also well-developed in this zone, with Chir Pine as a very useful commercial tree. Deodar, a highly valued endemic species grows mainly in the western part of the Himalayan range. Deodar is a durable wood mainly used in construction activity. Similarly, the chinor and the walnut, which sustain the famous Kashmir handicrafts, belong to this zone. Blue pine and spruce appear at altitudes of 2,225-3,048 m. At many places in this zone, temperate grasslands are also found. But in the higher reaches there is a transition to Alpine forests and pastures. Silver firs, junipers, pines, birch and rhododendrons, etc. occur between 3,000-4,000 m. However, these pastures are used extensively for transhumance by tribes like the Gujjars, the Bakarwals, the Bhotiyas and the Gaddis. The southern slopes of the Himalayas carry a thicker vegetation cover because of relatively higher precipitation than the drier north-facing slopes. At higher altitudes, mosses and lichens form part of the tundra vegetation.

The southern mountain forests include the forests found in three distinct areas of Peninsular India viz; the Western Ghats, the Vindhyas and the Nilgris. As they are closer to the tropics, and only 1,500 m above the sea level, vegetation is temperate in the higher regions, and subtropical on the lower regions of the Western Ghats, especially in Kerala, Tamil Nadu and Karnataka. The temperate forests are called Sholas in the Nilgris, Anaimalai and Palani hills. Some of the other trees of this forest of economic significance include magnolia, laurel, cinchona and wattle. Such forests are also found in the Satpura and the Maikal ranges.

<table>
<thead>
<tr>
<th>The Region</th>
<th>Percentage Cover of the Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) The region of high concentration</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>(ii) The region of high concentration</td>
<td>20-40</td>
</tr>
<tr>
<td>(iii) The region of low concentration</td>
<td>10-20</td>
</tr>
<tr>
<td>(iv) The region of very low concentration</td>
<td>&lt; 10</td>
</tr>
</tbody>
</table>

**Littoral and Swamp Forests**

India has a rich variety of wetland habitats. About 70 per cent of this comprises areas under paddy cultivation. The total area of wet land is 3.9 million hectares. Two sites- Chilika Lake (Orissa) and Keoladeo National Park (Bharatpur) are protected as water-fowl habitats under the Convention of Wetlands of International Importance (Ramsar Convention).
The country's wetlands have been grouped into eight categories, viz. (i) the reservoirs of the Deccan Plateau in the south together with the lagoons and other wetlands of the southern west coast; (ii) the vast saline expanses of Rajasthan, Gujarat and the Gulf of Kachchh; (iii) freshwater lakes and reservoirs from Gujarats through Rajasthan (Keoladeo National Park) and Madhya Pradesh; (iv) the delta wetlands and lagoons of India's east coast (Chilika Lake); (v) the freshwater marshes of the Gangetic Plain; (vi) the floodplains of the Brahmaputra; the marshes and swamps in the hills of northeast India and the Himalayan foothills; (vii) the lakes and rivers of the montane region of Kashmir and Ladakh; and (viii) the mangrove forest and other wetlands of the island arcs of the Andaman and Nicobar Islands.

Mangroves grow along the coasts in the salt marshes, tidal creeks, mud flats and estuaries. They consist of a number of salt-tolerant species of plants. Crisscrossed by creeks of stagnant water and tidal flows, these forests give shelter to a wide variety of birds.

In India, the mangrove forests spread over 6,740 sq. km which is 7 per cent of the world's mangrove forests. They are highly developed in the Andaman and Nicobar Islands and the Sunderbans of West Bengal. Other areas of significance are the Mahanadi, the Godavari and the Krishna deltas.

These forests too, are being encroached upon, and hence, need conservation.

**Forest cover in India**

According to state records, the forest area covers 23.28 per cent of the total land area of the country. The forest area is the area notified and recorded as the forest land irrespective of the existence of trees, while the actual forest cover is the area occupied by forests with canopy. The former is based on the records of the State Revenue Department, while the latter is based on aerial photographs and satellite imageries. In 2001, the actual forest cover was only 20.55 per cent. Of the forest cover, the share of dense and open forests was 12.60 per cent and 7.87 per cent respectively.

Both forest area and forest covers vary from state to state. Lakshadweep has zero per cent forest area; Andaman and Nicobar Islands have 86.93 per cent. Most of the states with less than 10 per cent of the forest area lie in the north and northwestern part of the country. These are Rajasthan, Gujarat, Punjab, Haryana and Delhi.

Most of the forests in Punjab and Haryana have been cleared for cultivation. States with 10-20 per cent forest area are Tamil Nadu and West Bengal. In Peninsular India, excluding Tamil Nadu, Dadra and Nagar Haveli and Goa, the area under forest cover is 20-30 per cent. The northeastern states have more than 30 per cent of the land under forest. Hilly topography and heavy rainfall are good for forest growth.

There is a lot of variation in actual forest cover, which ranges from 9.56 per cent in Jammu and Kashmir to 84.01 per cent in Andaman and Nicobar Islands. From the table showing the distribution of forests in India, it is clear that there are 15 states where the forest cover is more than one-third of the total area, which is the basic requirement for maintaining the ecological balance.

On the basis of the percentage of the actual forest cover, the states have been grouped into four regions.

**Forest Conservation**

Forests have an intricate interrelationship with life and environment. These provide numerous direct and indirect advantages to our economy and society. Hence, conservation of forest is of vital importance to the survival and prosperity of humankind. Accordingly, the Government of India proposed to have a nation-wide forest conservation policy, and adopted a forest policy in 1952, which was further modified in 1988. According to the new forest policy, the Government will emphasis sustainable forest management in order to conserve and expand forest reserve on the one hand, and to meet the needs of local people on the other.

The forest policy aimed at: (i) bringing 33 per cent of the geographical areas under forest cover; (ii) maintaining environmental stability and to restore forests where ecological balance was disturbed; (iii) conserving the natural heritage of the country, its biological diversity and genetic pool; (iv) checks soil erosion, extension of the desert lands and reduction of floods and droughts; (v) increasing the forest cover through social forestry and afforestation on degraded land; (vi) increasing the productivity of forests to make timber, fuel, fodder and food available to rural population dependant on forests,
and encourage the substitution of wood; (vii) creating of a massive peoples movement involving women to encourage planting of trees, stop felling of trees, and thus, reduce pressure on the existing forest.

Based on the forest conservation policy the following steps were initiated:

**Social Forestry**

Social forestry means the management and protection of forests and afforestation on barren lands with the purpose of helping in the environmental, social and rural development.

The National Commission on Agriculture (1976) has classified social forestry into three categories. These are Urban forestry, Rural forestry and Farm forestry.

Urban forestry pertains to the raising and management of trees on public and privately owned lands in and around urban centres such as green belts, parks, roadside avenues, industrial and commercial green belts, parks, roadside avenues, industrial and commercial green belts, etc.

Rural forestry lays emphasis on promotion of agro-forestry and community-forestry. Agro-forestry is the raising of trees and agriculture crops on the same land inclusive of the waste patches. It combines forestry with agriculture, thus, altering the simultaneous production of food, fodder, fuel, timber and fruit. Community forestry involves the raising of trees on public or community land such as the village pasture and temple land, roadside, canal bank, strips along railway lines, and schools etc. Community forestry programme aims at providing benefits to the community as a whole. Community forestry provides a means under which the people of landless classes can associate themselves in tree raising and thus, get those benefits which otherwise are restricted for landowners.

**Farm Forestry**

Farm forestry is a term applied to the process under which farmers grow trees for commercial and non-commercial purposes on their farm lands.

**Wildlife**

Wildlife of India is a great natural heritage. It is estimated that about 4-5 per cent of all known plant and animal species on the earth are found in India. There are certain species that are at the brink of extinction.

Some estimates suggest that at least 10 per cent of India’s recorded wild flora and 20 per cent of its mammals are on the threatened list.

Let us now understand the different categories of existing plants and animal species. Based on the International Union for Conservation of Nature and Natural Resources (IUCN), we can classify as follows-

**Normal Species**: Species whose population levels are considered to be normal for their survival, such as cattle, sal, pine, rodents, etc.

**Endangered Species**: These are species which are in danger of extinction. The survival of such species is difficult if the negative factors that have led to a decline in their population continue to operate. The examples of such species are black buck, crocodile, Indian wild ass, Indian rhino, lion tailed macaque, sangai (brow anter deer in Manipur), etc.

**Vulnerable Species**: These are species whose population has declined to levels from where it is likely to move into the endangered category in the near future if the negative factors continue to operate. The examples of such species are blue sheep, Asiatic elephant, Gangetic dolphin etc.

**Rare Species**: Species with small population may move into the endangered or vulnerable category if the negative factors affecting them continue to operate. The examples of such species are the Himalayan brown bear, wild Asiatic buffalo, desert fox and hornbill, etc.

**Endemic Species**: These are species which are only found in some particular areas usually isolated by natural or geographical barriers. Examples of such species are the Andaman teal, Nicobar pigeon, Andaman wild pig, mithun in Arunachal Pradesh.

**Extinct Species**: These are species which are not found after searches of known or likely areas where they may occur. A species may be extinct from a local area, region, country, continent or the entire earth. Examples of such species are the Asiatic cheetah, pink head duck.

**Wildlife Conservation in India**

The protection of wildlife has a long tradition in...
India. Many stories of Panchtantra and Jungle Books, etc. have stood the test of time relating to the love for wildlife. These have a profound impact on young minds.

In 1972, a comprehensive Wildlife Act was enacted, which provides the main legal framework for conservation and protection of wildlife in India. The two main objectives of the Act are; to provide protection to the endangered species listed in the schedule of the Act and to provide legal support to the conservation areas of the country classified as National parks, sanctuaries and closed areas. This Act has been comprehensively amended in 1991, making punishments more stringent and has also made provisions for the protection of specified plant species and conservation of endangered species of wild animals.

There are 92 National parks and 492 wildlife sanctuaries covering an area of 15.67 million hectares in the country.

Wildlife conservation has a very large ambit with unbounded potential for the wellbeing of humankind. However, this can be achieved only when every individual understands its significance and contributes his bit.

For the purpose of effective conservation of flora and fauna, special steps have been initiated by the Government of India in collaboration with UNESCO’s ‘Man and Biosphere Programme’.

Special schemes like Project Tiger (1973) and Project Elephant (1992) have been launched to conserve these species and their habitat in a sustainable manner.

Project Tiger has been implemented since 1973. The main objective of the scheme is to ensure maintenance of viable population of tigers in India for scientific, aesthetic, cultural and ecological values, and to preserve areas of biological importance as natural heritage for the benefit, education and enjoyment of the people. Initially, the Project Tiger was launched in nine tiger reserves, covering an area of 16,339 sq. km, which has now increased to 27 tiger reserves, encompassing 37,761 sq. km of tiger habitats distributed in 17 states. The tiger population in the country has registered an increase from 1,827 in 1972 to 3,642 in 2001-2002.

Project Elephant was launched in 1992 to assist states having free ranging population of wild elephants. It was aimed at ensuring long-term survival of identified viable population of elephants in their natural habitat. The project is being implemented in 13 states.

Apart from this, some other projects such as Crocodile Breeding Project, Project Hangul and conservation of Himalayan Musk deer have also been launched by the Government of India.

Biosphere Reserves

A Biosphere Reserve is a unique and representative ecosystem of terrestrial and coastal areas which are internationally recognized within the framework of UNESCO’s Man and Biosphere (MAB) Programme. The Biosphere Reserve aims at achieving the three objective as depicted in Figure.

There are 16 Biosphere Reserves in India. Four Biosphere Reserves. Namely (i) Nilgiri; (ii) Nanda Devi; (iii) Sunderbans; and (iv) Gulf of Mannar have been recognized by the UNESCO on World Network of Biosphere Reserves.

Nilgiri Biosphere Reserve

The Nilgiri Biosphere Reserve (NBR), the first of the fourteen biosphere reserves of India, was established in September 1986. It embraces the sanctuary complex of Wyanad, Nagarhole, Bandipur and Mudumalai, the entire forested hill slopes of Nilambur, the Upper Nilgir plateau, Silent Valley and the Siruvani hills. The total area of the biosphere reserve is around 5,520 sq. km.

The Nilgiri Biosphere Reserve possesses different habitat types, unspoilt areas of natural vegetation types with several dry scrubs, dry and moist deciduous, semi evergreen and wet evergreen forests, evergreen shoals, grasslands and swamps. It includes the largest known population of two endangered animal species, namely the Nilgiri Tahr and the Lion-tailed macaque. The largest south Indian population of elephant, tiger, gaur, sambar and chital as well as a good number of endemic and endangered plants are also found in this reserve. The habitat of a number of tribal groups remarkable for the traditional modes of harmonious use of the environment are also found here.

The topography of the NBR is extremely varied, ranging from an altitude of 250 m to 2,650 m. About
80 per cent of the flowering plants reported from the Western Ghats occur in the Nilgiri Biosphere Reserve.

**Nanda Devi Biosphere Reserve**

The Nanda Devi Biosphere Reserve situated in Uttarakhand includes parts of Chamoli, Almora, Pithoragarh and Bageshwar districts.

The major forest types of the reserve are temperate. A few important species are silver weed and orchids like latifolie and rhododendron. The biosphere reserve has a rich fauna, for example the snow leopard, black bear, brown bear, musk deer, snowcock, golden eagle and black eagle.

Major threats to the ecosystem are the collection of endangered plants for medicinal use, forest fires and poaching.

**Sunderbans Biosphere Reserve**

It is located in the swampy delta of the river Ganga in West Bengal. It extends over a vast area of 9,630 sq. km. and consists of mangrove forests, swamps and forested islands. Sundarbans is the home of nearly 200 Royal Bengal tigers.

The tangled mass of roots of mangrove trees provide safe homes for a large number of species, from fish to shrimp. More than 170 birds species are known to inhabit these mangrove forests.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Biosphere Reserve</th>
<th>Total Geographical Area (km²)</th>
<th>Location (States)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nilgiri</td>
<td>5,520</td>
<td>Part of Wynad, Nagarhole, Bandipur and Mudumalai, Nilambur, Silent Valley and Struvant Hills (Tamil Nadu, Kerala and Karnataka)</td>
</tr>
<tr>
<td>2.</td>
<td>Nanda Devi</td>
<td>2,236.74</td>
<td>Part of Chamoli, Pithoragarh and Almora districts (Uttar Pradesh) and part of Garo Hills (Meghalaya)</td>
</tr>
<tr>
<td>3.</td>
<td>Nokrek</td>
<td>820</td>
<td>Part of Garo Hills (Meghalaya)</td>
</tr>
<tr>
<td>4.</td>
<td>Manas</td>
<td>2,837</td>
<td>Part of Kokrajhar, Bongaona, Barpeta, Naibari, Kamrup and Darrang districts (Assam)</td>
</tr>
<tr>
<td>5.</td>
<td>Sunderbans</td>
<td>9,630</td>
<td>Part of delta of Ganges and Brahmaputra river system (West Bengal)</td>
</tr>
<tr>
<td>6.</td>
<td>Gulf of Mannar</td>
<td>10,500</td>
<td>Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu)</td>
</tr>
<tr>
<td>7.</td>
<td>Great Nicobar</td>
<td>885</td>
<td>Southernmost Islands of the Andaman and Nicobar (A&amp;N Islands)</td>
</tr>
<tr>
<td>8.</td>
<td>Stmillipal</td>
<td>4,374</td>
<td>Part of Mayurbhanj district (Orissa)</td>
</tr>
<tr>
<td>9.</td>
<td>Dibru Salkhowa</td>
<td>765</td>
<td>Part of Dibugarh and Tinsukia districts (Assam)</td>
</tr>
<tr>
<td>10.</td>
<td>Dthang Dibang</td>
<td>5,111.5</td>
<td>Part of Siang and Debang valley in Arunachal Pradesh</td>
</tr>
<tr>
<td>11.</td>
<td>Kanchenjunga</td>
<td>2,619.92</td>
<td>Parts of North and West Sikkim</td>
</tr>
<tr>
<td>12.</td>
<td>Pachman</td>
<td>4,926.28</td>
<td>Parts of Betul, Hoshangabad and Chindwara districts of Madhya Pradesh.</td>
</tr>
<tr>
<td>13.</td>
<td>Agasthya-malai</td>
<td>1,701</td>
<td>Agasthya malai Hills in Kerala</td>
</tr>
<tr>
<td>14.</td>
<td>Achanakmar-Amarkantak</td>
<td>3,835.51</td>
<td>Parts of Anupur and Dindori district of MP and parts of Bilaspur district of Chhatisgarh</td>
</tr>
</tbody>
</table>
Adapting itself to the saline and fresh water environment, the tigers at the park are good swimmers, and they hunt scarce preys such as chital deer, barking deer, wild pig and even macaques. In the Sunderbans, the mangrove forests are characterized by Heritiera fomes, a species valued for its timber.

**Gulf of Mannar Biosphere Reserve**

The Gulf of Mannar Biosphere Reserve covers an area of 105,000 hectares on the southeast coast of India. It is one of the world’s richest regions from a marine biodiversity perspective. The biosphere reserve comprises 21 islands with estuaries, beaches, forests of the near shore environment, sea grasses, coral reefs, salt marshes and mangroves. Among the Gulf’s 3,600 plant and animal species are the globally endangered sea cow (Dugong dugon) and six mangrove species, endemic to Peninsular India.