

BIOSPHERE RESERVES

A biosphere reserve is a unique kind of protected area that differs from a national park, wilderness area, national forest, or wildlife refuge in having three very different, but equal, aims:

- **Conservation** of genetic resources, species and ecosystem;
- **Scientific research and monitoring;** and
- **Promoting sustainable development** in communities of the surrounding region.

All three of these aims are equally important in a biosphere reserve. National parks and other kinds of protected natural areas usually are primarily concerned with conservation, and only secondarily with research and sustainable development.

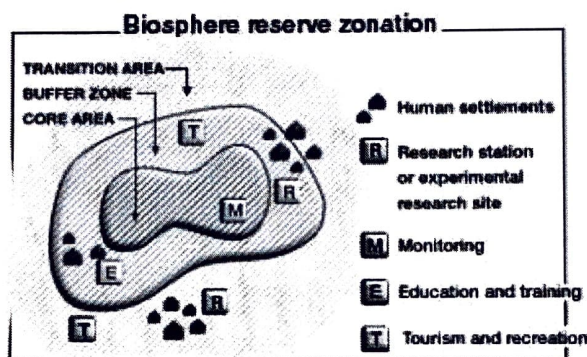
The idea of biosphere reserves was initiated by UNESCO in 1973-74 under its Man and the Biosphere (MAB) Programme. The MAB launched in 1971 by UNESCO proposes an interdisciplinary research agenda and capacity building, aiming to improve the relationship of people with their environment globally. Man and the Biosphere Programme is governed by the MAB Council or the International Co-ordinating Council (ICC), consisting of 34 Member States (countries) elected by UNESCO's biennial General Conference. The MAB ICC guides and supervises the MAB programme, review the progress and recommend research projects to the countries.

Man and the Biosphere programme targets the ecological, social and economic dimensions of biodiversity loss. It uses its World Network of Biosphere Reserves (WNBR) as a vehicle for knowledge sharing, for research and monitoring, for education and training, and in participatory decision making.

The purpose of formation of biosphere reserves is to conserve in-situ all forms of life, along with its support system, in its totality, so that it could serve as a referral system for monitoring and evaluation of changes in natural ecosystem. To fulfill the aims a biosphere reserve is divided into 3 zones:

1. **Core area:** The central core area of a biosphere reserve is legally protected, where no human activity is allowed. The biological communities and ecosystems are strictly protected.

2. **Buffer zone:** Usually surrounds and adjoins the core area, where limited human activities are permitted. The human activities are monitored and non-destructive researches are carried out.
3. **Transition Zone:** Surrounding the buffer area is the transition zone. This area may contain small villages, farms, fisheries and limited non destructive human activities are allowed. Here the local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources.



Schematic depiction of the three zones of biosphere reserves
and the kind of activities that take place in them

World's first biosphere reserve was established in 1979, since then the network of world's biosphere reserves have increased to 701 sites in 124 countries (Source: MAB 2020). At present, there are 18 biosphere reserves in India. Of them, 11 biosphere reserves are the part of World's Network of Biosphere Reserves (WNBR) (Source: MAB 2020).

List of India's biosphere reserves included in UNESCO's WNBR

#	Name	States/ UT	Year
1	Nilgiri Biosphere Reserve	Tamil Nadu, Kerala and Karnataka	2000
2	Gulf of Mannar Biosphere Reserve	Tamil Nadu	2001
3	Sundarbans Biosphere Reserve	West Bengal	2001
4	Nanda Devi Biosphere Reserve	Uttarakhand	2004
5	Nokrek Biosphere Reserve	Meghalaya	2009
6	Pachmarhi Biosphere Reserve	Madhya Pradesh	2009
7	Simlipal Biosphere Reserve	Odisha	2009
8	Great Nicobar Biosphere Reserve	Andaman & Nicobar Islands	2013
9	Achanakmar-Amarkantak Biosphere Reserve	Chhattisgarh, Madhya Pradesh	2012 ⁱ
10	Agasthyamalai Biosphere Reserve	Kerala and Tamil Nadu	2016
11	Khangchendzonga National Park	Sikkim	2018

List of biosphere reserves in India

Biosphere reserves of India							
	Year	Name	Location	State	Type	Key fauna	Area (km ²)
1	1986	Nilgiri Biosphere Reserve	Part of Waynad, Nagarhole, Bandipur and Mudumalai, Nilambur, Silent Valley	Tamil Nadu, Kerala and Karnataka	Western Ghats	Nilgiri tahr, tiger, lion-tailed macaque	5520
2	1988	Nanda Devi Biosphere Reserve	Parts of Chamoli District, Pithoragarh District & Bageshwar District	Uttarakhand	Western Himalayas	Snow leopard, Himalayan black bear	5860
3	1989	Gulf of Mannar	Indian part of Gulf of Mannar extending from Rameswaram island in the north to Kanyakumari in the south of Tamil Nadu and Sri Lanka	Tamil Nadu	Coasts	Dugong	10500
4	1988	Nokrek	In west Garo Hills	Meghalaya	Eastern hills	Red panda	820.00
5	1989	Sundarbans	Part of delta of Ganges and Brahmaputra river system	West Bengal	Gangetic Delta	Royal Bengal tiger	9630
6	1989	Manas	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamrup and Darrang Districts	Assam	Eastern Hills	Asiatic elephant, tiger, Assam roofed turtle, hispid hare, golden langur, pygmy hog	2837
7	1994	Simlipal	Part of Mayurbhanj district	Odisha	Deccan Peninsula	Gaur, royal Bengal tiger, Asian elephant	4374
8	1998	Dihang-Dibang	Part of Siang and Dibang Valley	Arunachal Pradesh	Eastern Himalaya	Mishmi takin, musk deer	5112
9	1999	Pachmarhi Biosphere Reserve	Parts of Betul District, Hoshangabad District and Chhindwara District	Madhya Pradesh	Semi-Arid	Giant squirrel, flying squirrel	4981.72
10	2005	Achanakmar-Amarkantak Biosphere Reserve	Part of Annupur, Dindori and Bilaspur districts	Madhya Pradesh, Chhattisgarh	Maikala Hills	Four-horned antelope, Indian wild dog, sarus crane, white-rumped vulture, sacred grove bush frog	3835
11	2008	Great Rann of Kutch	Part of Kutch, Morbi, Surendranagar and Patan districts; the largest biosphere reserve in India.	Gujarat	Desert	Indian wild ass	12454
12	2009	Cold Desert	Pin Valley National Park and surroundings; Chandratat and Sarchu & Kibber Wildlife Sanctuary	Himachal Pradesh	Western Himalayas	Snow leopard	7770
13	2000	Khangchendzonga	Parts of Kangchenjunga	Sikkim	East Himalayas	Snow leopard, red panda	2620
14	2001	Agasthyamalai Biosphere Reserve	Neyyar, Peppara and Shendurany Wildlife Sanctuary and their adjoining areas	Kerala, Tamil Nadu	Western Ghats	Nilgiri tahr, Asian elephant	3500.08

15	1989	Great Nicobar	Southernmost of the Andaman and Nicobar Islands	Andaman and Nicobar Islands	Islands	Saltwater crocodile	885
16	1997	Dibru-Saikhowa	Part of Dibrugarh and Tinsukia districts	Assam	Eastern Hills	White-winged wood duck, water buffalo, black-breasted parrotbill, tiger, capped langur	765
17	2010	Seshachalam Hills	Seshachalam Hill Ranges covering parts of Chittoor and Kadapa districts	Andhra Pradesh	Eastern Ghats	Slender loris	4755
18	2011	Panna	Part of Panna District and Chhatarpur District	Madhya Pradesh	Catchment Area of the Ken River	Tiger, chinkara, chital, sambhar and sloth bear	2998.98

Major Vegetational Belts of India
Floristic (Botanical) Regions of India

As ^{The} Indian sub-continent is characterised with a variety of climate types, flora of the country is also correspondingly of different types in different parts. For the study of flora, the country has been divided into following nine floristic regions (Fig. 2). (i) Western Himalayas, (ii) Eastern Himalayas, (iii) West Indian

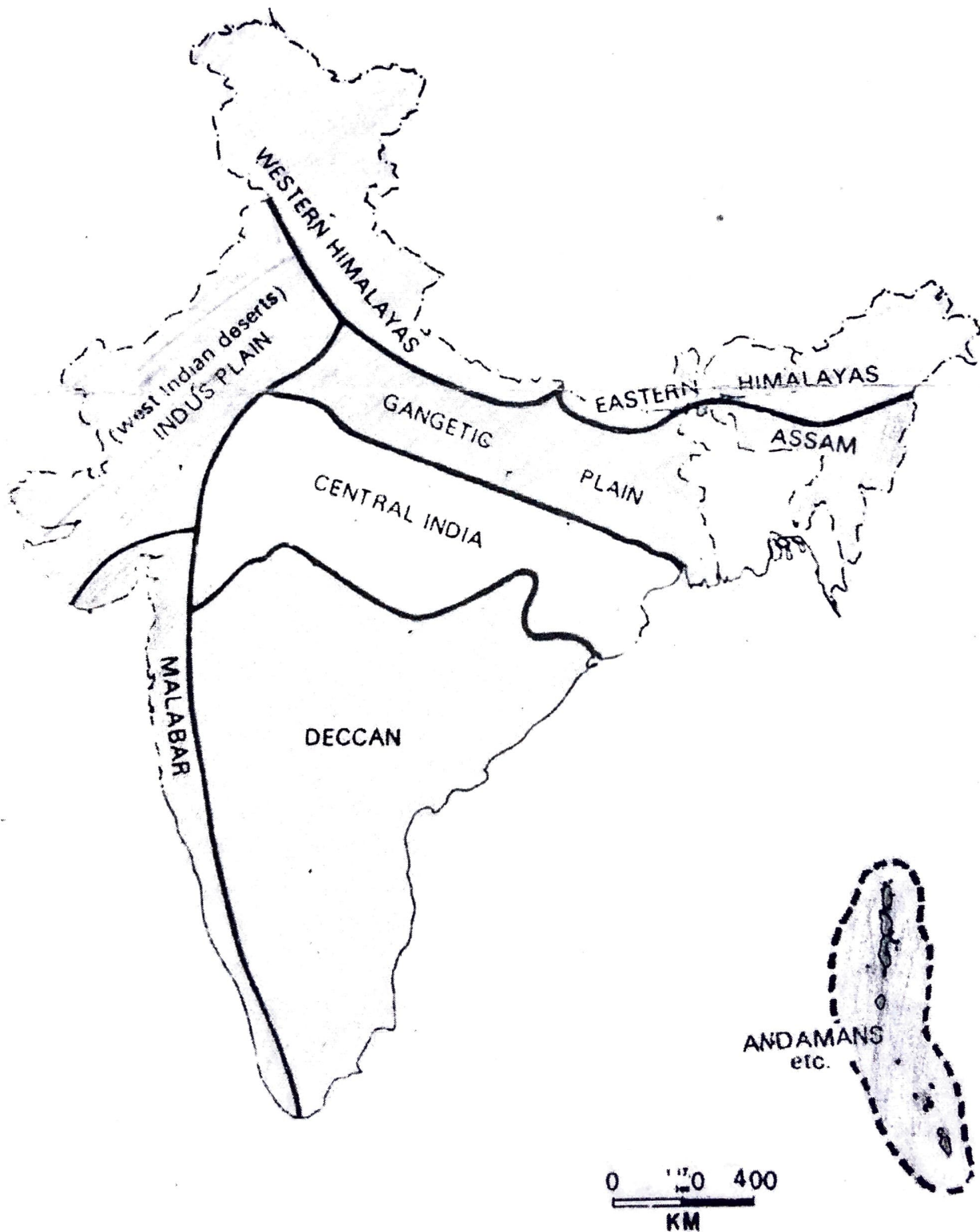


Fig. 2. Map showing different floristic regions of India.

Deserts, (iv) Gangetic plain, (v) Assam, (vi) Central India, (vii) Malabar, (viii) The Deccan, and (ix) Andamans.

[I] Western Himalayas

It extends from central region of Kumaon to north west region of Kashmir. Altitudinally there are three zones of vegetation corresponding to three climatic belts.

1. Submontane or lower region (tropical and subtropical). From about 1,000 to 5,000 ft. above sea level in regions of Siwaliks and adjacent areas. The forest is dominated by timber trees of *Shorea robusta*. In riverain regions trees of *Dalbergia sissoo* are dominant, while in more moist soils, dominants are *Cedrela toona*, *Ficus glomerata* and *Eugenia jambolana*. In isolated patches of grasses, there are present trees of *Acacia catechu* and *Butea monosperma*. In dry belts towards west, *Shorea robusta* is replaced by such xerophytes as *Zizyphus*, *Carissa*, *Acacia*, etc. with thorny succulent euphorbias on slopes. *Pinus roxburghii* begins to appear at 3,000 to 5,000 ft. Ground vegetation is poor.

2. Temperate or montane zone. From 5,000 to 11,675 ft. above sea level. At about 5,500 ft. *Pinus longifolia* is generally replaced by *P. excelsa*. From 5,500 ft. to 6,000 ft. *Cedrus deodara* is quite abundant forming pure forest stands. At these altitudes *Quercus incana* also grows as separate patches. In the inner Himalayas in Kashmir, *Betula* (birch), *Salix* (cane) and *Populus* (poplar) are abundant on certain soil types. At higher altitudes, *Aesculus indica* (horse chestnut), *Quercus semecarpifolia*, *Q. dilatata* along with the conifers such as *Abies pindrow*, *Picea morinda*, *Cupressus torulosa*, *Taxus baccata* etc. are most common components of vegetation. *Rhododendron campanulatum* grows at higher altitudes. In inner valleys on dry mountains, *Pinus gerardiana* is also found. In dry areas of Punjab, wheat and barely are cultivated, while in wet valley of Kashmir, rice is the common crop. Other common plants grown in Kashmir are, saffron (*Crocus sativus*), apples, peaches, walnuts, almonds etc.

3. Alpine zone. It is the limit of tree growth at about 12,000 ft. known as timber or tree line, where the plants' height is considerably reduced. Plants are mostly dwarfed and cushionshaped shrubs and grasses. At about 15,000 ft. and above-snow line, plant growth is almost nil. On lower levels of this zone, some rhododendrons, *Betula utilis* and small junipers are present. Above this zone there are present many types of herbs, with short period of vegetative growth and flowering. These include *Primula*, *Potentilla*, *Polygonum*, *Geranium*, *Saxifraga*, *Aster* etc.

[II] Eastern Himalayas

It consists of regions of Sikkim and extends in the east upto NEFA. In its vegetational zones, it is similar to the western Himalayas. On the whole, the eastern Himalayas have more tropical elements, greater variety of oaks and rhododendrons and less of conifers than the western Himalayas. The chief differences are the higher rainfall and warmer conditions in this part of Himalayas. The tree and snow lines are higher by about 1,000 ft. than the corresponding lines on

western Himalayas. Species diversity and vegetation density are higher in the east. This region is also divided into three zones.

1. Submontane zone. Due to warm and humid weather, it is typically tropical with dense forests of *Shorea robusta*. It extends from the plain foot of the hill upto 6,000 ft. altitude. In riverain area there are forests of *Dalbergia sissoo* and *Acacia catechu*. Mixed forests of deciduous trees like *Sterospermum*, *Cedrela toona*, *Bauhinia*, *Anthocephalus cadamba*, *Lagerstroemia pavriflora* are predominant. Tall trees like *Albizia procera*, *Salmalia*, *Artocarpus chaplasha*, bamboo (*Dendrocalamus*) are important.

2. Temperate zone. It ranges between 6,000 to 12,000 ft. altitude above sea level. The lower region has several species of oaks, such as *Quercus lemelloso* and *Q. lineata*, *Michelia*, *Cedrela* and *Eugenia*. The upper region which is cooler, has such conifers as *Juniperus*, *Cryptomeria*, *Picea*, *Abies*, and *Tsuga*. One bamboo, *Arundinaria* sp. is also common. Some rhododendrons are also common at higher elevations.

3. Alpine zone. It is above 12,000 ft. where vegetation is devoid of trees. Shrubby growth of *Juniperus* and *Rhododendron* is found in grassy areas.

[III] West Indian deserts (Indus plain)

This region consists of parts of Rajasthan, Kutch, Delhi and part of Gujarat. The climate is characterised by very hot and dry summer, and cold winter. Rainfall is less than 70 cm. The plants are mostly xerophytic, such as *Acacia nelotica*, *Prosopis spicifera*, *P. juliflora*, *Salvadora oleoides*, *S. persica*, *Tecomella*, *Capparis aphylla*, *Tamarix dioica*, and *Zizyphus nummularia*. The ground vegetation is mostly represented by small *Calotropis* sp., *Panicum antidotale*, *Eleusine* sp., *Tribulus terrestris* etc. Some common species used in plantations are *Saccharum munja*, *Panicum antidotale*, *Cenchrus ciliaris*, *Capparis aphylla*, *Tamarix articulata*, *Prosopis spicifera*, *P. juliflora*, *Acacia leucophloea* and *A. senegal*.

[IV] Gangetic plain

This region comprising Uttar Pradesh, Bihar and Bengal is most fertile region. The chief climatic factors, the temperature and rainfall together are responsible for distinct type of vegetation. Rainfall is less than 70 cm in west U.P., being more than 150 cm in Bengal. Vegetation is chiefly of tropical moist and dry deciduous forest type. In north-western U.P., near foothills of the Himalayas, *Dalbergia sissoo* and *Acacia nelotica* are most common. In south-west U.P., there are desert areas, where characteristic species are *Capparis aphylla*, *Saccharum munja*, *Acacia nelotica* etc. In eastern U.P., *Butea monosperma* (dhak), *Madhuca indica* (mahua), *Terminalia arjuna* (arjun), *Buchanania lanzan* (chiraunji), *Diospyros melanoxylon* (tendu), *Cordia myxa* (lisora), *Sterculia urens*, *Boswellia serrata* (salai), *Acacia catechu* (Khair), *Azadirachta indica* (neem), *Mangifera indica* (mango), *Ficus bengalensis* (bargad), *F. religiosa* (pipal) are most dominant trees. Besides them, some weeds and grasses like *Xanthium strumarium*, *Cassia tora*, *Argemone mexicana*, *Amaranthus* sp., *Peristrophe bicalyculata*,

Dichanthium annulatum, *Bothriochloa pertusa* etc. are also present. In Gangetic delta region extreme swampy and halophytic vegetation is common, where dominant species are *Rhizophora mucronata*, *R. conjugata*, *Acanthus ilicifolius*, *Kandelia rheedii*, *Bruguiera gymnorhiza*, *Ceriops roxburghiana* etc.

[V] Assam

This region receives the heaviest rainfall, with Cherrapunji as much as more than 1000 cm. The temperature and wetness are very high, which are responsible for dense tropical evergreen forests. Some of the important trees are *Dipterocarpus macrocarpus*, *Mesua ferrea*, *Michelia champaca*, *Shorea robusta*, *Artocarpus chaplasha*, *Alstonia scholaris*, *Sterculia alata*, *Lagerstroemia flos-regina*, *Ficus elastica* etc. Some bamboos, as *Bambusa pallida*, *Dendrocalamus hamiltonii*, *Calamus* sp. grasses as *Imperata cylindrica*, *Saccharum arundinaceum*, *Themeda* sp., *Phragmites* sp., and insectivorous plants like *Nepenthes* sp. are also present. In northern cooler regions, *Alnus nepalensis*, *Rhododendron arboreum*, *Betula* sp. are also found. In hilly tracts, some conifers like *Pinus khasiya* and *P. insularis* are also present.

[VI] Central India

It comprises Madhya Pradesh, parts of Orissa, and Gujarat. Depending upon the amount of rainfall, forests have developed into thorny, mixed deciduous and sal types. The forest vegetation is chiefly constituted by *Tectona grandis*, *Diospyros melanoxylon*, *Butea monosperma*, *Terminalia tomentosa* and *Dalbergia latifolia*. The thorny vegetation consists of *Carissa spinarum*, *Zizyphus rotundifolia*, *Acacia leucophloea*, *A. catechu*, *Butea frondosa* etc.

[VII] Malabar

This region comprises the western coast of India extending from Gujarat in the north to the Cape Camorin in the south. Rainfall is heavy. The vegetation is of four types—tropical moist evergreen forests, mixed deciduous forests, subtropical or temperate evergreen forests and the mangrove forests. The tropical wet evergreen forests are very luxuriant and multistoreyed, with such tall trees as *Dipterocarpus indicus*, *Sterculia alata*, *Cedrela toona*, *Tectona grandis* and *Dalbergia latifolia*. Bamboos, like *Dendrocalamus strictus* and *Bambusa arundinacea* are also present.

In the Nilgiri hills, there are temperate evergreen forests of such trees as *Eurya japonica*, *Michelia nilagirica* and *Gordonia obtusa* known as the sholas.

[VIII] The Deccan

This region is drier with rainfall of about 10 cm. It includes Andhra Pradesh, Tamilnadu and Karnataka. It has a central hilly plateau with forests of *Boswellia serrata*, *Tectona grandis* and *Hardwickia pinnata*, and the low eastern dry Coromandal coast, with tropical dry evergreen forests of *Santalum album* (chandan), *Cedrela toona* and plants like *Capparis*, *Phyllanthus*, *Euphorbia* sp.

[IX] Andamans

It has a wide range of spreading coastal vegetation like mangroves, beech forests and in the interior evergreen forests of tall trees. There are some pockets of dry areas also. Important species of the island are *Rhizophora*, *Mimusops*, *Calophyllum*, *Dipterocarpus*, *Lagerstroemia* and *Terminalia*. Most of the area is now cleared for paddy and sugarcane cultivation.