Environment of India

Introduction

India has some of the most varied geography in the world. What makes it unique is the fact that almost every kind of environment exists in India: from dense forests to deserts, from alpine meadows to coastal areas and from tropical forests to grasslands. It is rightly termed as a sub-continent, because it encompasses incredible variety in spite of its relatively small size.

The amazing variety in geography of the Indian subcontinent translates into an equally mindboggling variety in natural environment, which in turn means that a wide range of flora and fauna characterise these environments. India is one of the seventeen megadiverse countries. According to one study, India along with other 16 mega diverse countries is home to about 60-70% of the world's biodiversity. India on its own boasts of about 7.6% of all mammals, 12.6% of all birds, 6.2% of all reptiles, and 6.0% of all flowering plant species.

The diversity of India cannot be simply quantified in terms of numbers. It is not merely the sheer number of environments and species that makes India unique; it also houses some of the rarest ecological niches and species of flora and fauna in the world. A case in point is the Royal Bengal Tiger, our national animal; now numbering in a few thousands, they mostly occupy the deciduous forests of India and represent the last stable population of tigers in the wild in the world.

To gain a comprehensive understanding of the environment and the flora and fauna of the country, we will discuss each ecological habitat independently and the wildlife residing in it.

The Himalayas

Forming the crown of India, the Himalayas demarcate the Indian subcontinent from the rest of Asia, providing one of the chief factors why India's ecosystem is markedly unique when seen in the context of the whole continent.



The Himalayas are the tallest mountain range in the world.

The Himalayas themselves can be subdivided into several different divisions. The upper echelons and high-altitude valleys of the Himalayas such as Ladakh in Jammu and Kashmir and Spiti Valley in Himachal Pradesh are regions which get very little rainfall and consequently have very scanty vegetation. Moreover, they experience very harsh temperatures throughout the year. This means that a select few species of plants and animals are able to survive in this environment. Flora is extremely sparse except near river beds and the lower part of the valley.

Nevertheless, close to a thousand plant species call the upper reaches of the Himalayas their home. Higher up the food chain in these parts are a host of herbivores such as the Bharal or the Blue Sheep, the Ibex, the Himalayan Tahr, the Argali sheep and a few carnivores such as the mysterious Snow Leopard, the Himalayan Brown Bear and the Tibetan Sand Fox. Apart from this, the Himalayas are home to a wide range of birds: the Tibetan Partridge, the Himalayan snowcock and a vast majority of quail species.

The Himalayas of Himachal Pradesh, Uttarakhand and the upper reaches of Sikkim and Arunachal Pradesh have a slightly different ecology. Like Ladakh, the tree line is covered by a thick carpet of snow during winters and become sparsely vegetated once the snow recedes. However, below the tree line is an entirely different story. These parts are covered by coniferous and rhododendron forests with a thick canopy and light undergrowth. The wildlife is largely similar to that seen at higher altitudes with an addition of some lowland species such as the common leopard. In fact, we witness a specific type of local migration in these parts where they come downhill during extreme winter only to scale back up during summers.

The extreme weather coupled with rough terrain makes it difficult to study the wildlife of the region. Hence, a comprehensive understanding of the behaviour and abundance of the species is yet to be obtained.

The Terai Region

Nestled between the Shivaliks of the Himalayas and the Indo Gangetic Plains, is the region called Terai. The Terai region is characterised by tall grasslands, swamps, sal forests and scrub savannah. It extends from North Western India to Assam (where it is called Dooars) through Nepal. The Terai's climate is characterised by moderate temperatures and high precipitation during the monsoon season. One important characteristic is the abundance of wetlands; over 50 wetlands are located in the Terai region boasting an abundance of birds and other species.

The Terai hosts some of the most well-known national parks of India such as the Jim Corbett National Park in Uttarakhand, Dudhwa National Park in Uttar Pradesh and Manas and Kaziranga National parks in Assam. These national parks are the abode of some of the giants of Indian wildlife such as the Royal Bengal Tiger, the Asian Elephant, the Indian Rhinoceros and some extremely rare species such as the Hoolock Gibbon, the Pygmy Hog and the Brow Antlered Deer.

The Terai region is currently threatened by the expanding nature of the plains of the Ganga and Brahmaputra rivers. With every passing year, some of this unique ecosystem is being lost to crop fields.

The Indo Gangetic Plains

The Indo Gangetic plains stands out among all other environments of India purely due to the fact that unlike other environments, the natural ecosystems of this region have almost been completely obliterated. A case in point would be the Bengal florican. This is a bird which was at one point a common feature of wetlands across the plains but these days it is critically endangered and is restricted to a few safe havens.

Until recent history, the Indo Gangetic Plains were home to large species such as the Royal Bengal Tiger, Asian Elephant, different species of Rhinoceros and even the Asiatic Lion. Similarly, in the several rivers that meander through this region, there was an abundance of gharials, crocodiles, river dolphins and freshwater fishes. In recent times, most of the natural grasslands have been replaced by settlements and crop fields, with the wildlife having been exterminated. At the same time, human abuse has rendered the rivers inhospitable for several fish species and most of the large aquatic species are restricted to protected areas. A few hundred Gangetic River Dolphins can be still found in the river Ganga whereas the crocodiles and the gharials are restricted to wildlife sanctuaries.

The Great Indian Desert

Occupying large parts of western India is the Great Indian Desert, also commonly known as Thar desert is characterised by extremely low precipitation, scanty vegetation, extremely hot days and cooler nights. However, the inhospitable nature of the Thar desert is largely due to low precipitation and very few sturdy species can survive here. The plants have adaptations such as leaves which have turned into spines, deeper roots, thick and fleshy leaves and stems to survive in such conditions. The animals too show adaptations such as the ability to extract water from leaves and store water for longer intervals.



The Thar desert occupies a large part of Rajasthan.

Some of the widespread plant species of the desert are Acacia and Cacti. The Thar desert is a mixture of dry scrub forests and parts characterised by sand dunes. In spite of the lack of vegetation there is a substantial herbivore population represented by species such as the Chinkara and its rarer cousin, the Indian Blackbuck. One of the great conservation stories of India revolves around the Bishnois who have been protecting this species for centuries and have provided a safe haven within and in the vicinity of their homes.

The extremely arid parts of the desert are not inhabited by any large carnivores, however, some national parks such as the Ranthambore and Sariska have a population of tigers and leopards. Apart from these, the Indian wolf, Desert Fox and Caracal constitute the majority of the carnivores. Apart from this, the Thar desert also boasts of a healthy population of winged predators such as eagles, kites and falcons.

South of the Thar lies one of the most unique habitats of India: the Rann of Kutch. It is a lowlying salt marsh and like the rest of the Thar desert, does not possess much vegetation. But it is a great habitat for migratory birds such as the Greater Flamingo which flock in huge numbers in the winter. It is also the only natural habitat of the endangered Asiatic Wild Ass.

Further south, in the semi-arid forests of Gir, lies the last abode of the Asiatic Lion, a species that has been resurrected from a few remaining individuals to a current relatively healthy population of close to 400 individuals.



The Gir Forest is the last natural habitat of the Asiatic Lion

Flora of India

The wide range of climatic conditions has provided India with a rich variety of vegetation that hardly any other country can boast of. Flora of India can be divided into Western Himalayas, Eastern Himalayas, Assam, Indus Plains, Ganga Plains, Deccan, Malabar and the Andamans.

Conifers like deodar, blue pine, spruce, junipers and silver fir are abundant in the Western Himalayan region, while laurels, rhododendrons, alder, maples and dwarf willows are found in the Eastern Himalayas. North Eastern India abounds in bamboo and tall grasses. The Indus plain supports scanty vegetation while the Deccan region is full of scrubs and mixed deciduous forests. Commercial crops like coconut, betel, pepper, coffee and tea are grown in Malabar region. The Andaman islands are full of evergreen mangrove forests.

Tropical Rainforests

While India does not strictly lie in the equatorial region, incessant rainfall due to the monsoons enables growth of dense tropical forests in some parts of the country. The prime rainforests of India are those in the Western Ghats, which run from Maharashtra up to the Nilgiris in the South. Effectively an elongated and thin strip along the Western coast, this belt of dense forests possesses the maximum biodiversity anywhere in India. Tropical rainforests are found in the Andaman and Nicobar Islands, and the greater Assam region on north-east. These forests contain trees of great commercial importance e.g. Indian Rosewood, Malabar Kino, Teak and Indian Laurel.

The Western Ghats' vast biodiversity includes 325 globally threatened species. It boasts 329 species of mammals out of which 13 are endemic. All the major Indian mammals such as the Royal Bengal Tiger, the Asiatic Elephant, Gaur and Common Leopard are represented here. The populations of birds and reptiles are equally diverse. However, it is the diversity of amphibians that makes the Western Ghats truly unique. There are 179 amphibian species out of which an astonishing 80% are endemic. Apart from that, the streams and river systems of the Western Ghats are home to 288 different varieties of fishes. The region also boasts of a rich variety in birds (508 species) and insects (around 6,000 species). There are also 7,400 different species of flowering plants out of which around 5,600 species are native or indigenous.

Deciduous and Evergreen Forests

Evergreen, deciduous and dry deciduous forests occupy most of central, western and eastern India. Over decades of conservation, several wildlife sanctuaries and national parks have been carved out in this region. Some of the major national parks of India fall in this region such as the Kanha National Park, Bandhavgarh National Park, Bandipur National Park, Tadoba National Park, and Simlipal National Park.

These forests are also important for holding some of the most economically important tree species such as sandalwood, sal, teak and mahogany. These forests are home to species such as elephants, tigers, leopards and several species of deer. Thousands of tourists throng these national parks every year to see these animals.

However the pressures of a growing population, and increasing human settlement has put severe pressure on our national parks and wildlife sanctuaries. The habitats are getting increasingly fragmented and as a result of this, inter-park movement of animals is becoming more and more difficult. This restricted nature of habitat could lead to a loss in genetic diversity. At the same time, it makes life tough for migratory species such as elephants. Loss of natural corridors connecting these individual protected areas has resulted in increasing man-animal conflict. Another factor that is accentuating man-animal conflict is the fact that human settlements are very close to or are encroaching upon the natural habitats of animals.

Plants of Cultural Significance

Banyan Tree

It is the National Tree of India. It has one of the widest reaching roots and easily covers several hectares. Its branches spread out and send trunk-like roots to the ground in order to support and expand itself. They are mainly found in the sub-Himalayan region and in the deciduous forests.

It holds its own cultural importance in Indian culture. Lord Krishna has praised the Banyan tree in Bhagavad Gita. It is also known as the *'Kalpa Vriksha'*, the tree that fulfils one's wishes. It symbolizes the Trimurti, with Vishnu as its bark, Shiva as the branches, and Bramha as its roots.

Peepal Tree

Also known as the 'Bodhi tree', it is a large, fast growing deciduous tree with heart-shaped leaves and wide spreading branches. It bears a purple coloured fruit and is one of the trees with longest life-span. It is mainly grown in the state of Haryana, Bihar, Kerala and Madhya Pradesh.

It is also used in traditional medicines for various diseases including Asthma. In Buddhism, the Peepal tree is considered to be the personification of Buddha since he attained enlightenment whilst being seated under a Peepal tree.

Neem Tree

The Sanskrit name of Neem is *Arishtha*, which meaning 'reliever of sickness'. It is an evergreen tree with small bright-green leaves and white flowers. It also has an olive like edible fruit which is oval in shape and has a thin skin.

The Neem tree is found throughout India and is quite popular in villages because of its multipurpose quality. It is a very important source for traditional cures and medicines in India. Almost every part is used in Ayurvedic medicine. Additionally it is also considered to be very auspicious and its leaves are used in several important rituals.

Tulsi

The Tulsi plant is a heavy-branched plant that attains the height of about 75-90 cm. It has round oval shaped leaves and purple flowers. Its growth is favoured by warm and tropical regions.

Tulsi has great medicinal value and is often taken as herbal tea. It contains essential oils used for various purposes. Leaves are used to make medicinal juices that help during cold, fever and cough. In Hindu culture, it is considered that Tulsi is dear to Lord Vishnu and it symbolises purity. People in India grow Tulsi as a religious plant and worship it.

Lotus

The lotus is the national flower of India. It is a water plant with broad floating leaves and bright fragrant flowers. It is found throughout India. It has medicinal value as well. Its seeds are believed to be beneficial for the heart as well as the kidneys. The leaves are used in combination with other herbs to treat various illnesses. It is considered a sacred flower in India. It symbolizes divinity, fertility, wealth and knowledge. It finds its mention in Indian mythology extensively.

Some Endemic plants of India

Polygala irregularis: It is commonly known as the milkwort and is both an annual and perennial herb. Generally found at an altitude of 1000m, its flowers are blue, pink and white in colour. The plants are on the brink of extinction because of habitat destruction.

Lotus Corniculatus: This plant is from the pea family. They bear yellow flowers that grow in a circle at the end of the stem. It is grown for pasture, hay and silage. The plants are perennial and herbaceous, similar to come clover.

Amentotaxus Assamica: The plant is also called the Assam catkin yew. They are small shrubs mainly found in the deciduous forests of Assam. It belongs to the species of coniferous trees that are found only in India.

Acacia planifrons: Also called the umbrella thorn, this plant grows as a shrub or a short tree. In Tamil they are called *kudai vel*. The tree is used as fuel and fodder for sheep and goats. When the tree is fully grown, it looks like a spread umbrella.

Nymphaea tetragona: It is a pygmy water lily confined to Jammu & Kashmir and Meghalaya. This small herb is very susceptible to pests and diseases. Buddist monks conserve them as ritual plants in temple gardens for offerings.

Coasts and Islands

India has a coastline that is approximately 7,500km in length. Its coastal regions range from the Gulf of Khambhat and Kutch in the West to Tamil Nadu in the south and then up to the Sundarbans in the East. These coastal areas offer a range of different habitats such as lagoons and backwaters, beaches, estuaries and mangrove forests. Each of these environments are unique in nature and possess its own characteristics. The coasts comprise mainly of sandy beaches. These beaches, although a hub of human activity as well, retain a substantial amount of wildlife. Chief among them is a variety of bird species such as Gulls, Terns, Skimmers and Lapwings. The coasts are also the breeding ground for turtle species such as Olive Ridley Turtle, Green Sea Turtle, Loggerhead Turtle and Leatherback Turtle.



The Andaman Islands

A few lagoons also dot the Indian coastal regions. A lagoon is a shallow body of water separated from the sea by some barrier. Some chief examples of lagoons in India are the Chilika Lake, the Pulicat Lake and the Kerala backwaters. The Chilika lake is a great example of biodiversity of the lagoons. This lake in coastal Odisha receives several migratory birds every winter as well as hosting a large number of local birds. However, the chief attraction of the lake is the Irrawaddy River Dolphin which is an endangered species.

However, the most unique environment of the coastal areas are the mangrove forests. They exist in areas with influx of brackish tidal water, such as estuaries and marine shorelines. The flora and fauna of this environment are adapted to survive.

Wildlife Conservation in India

India is unique for containing some of the greatest biodiversity on the planet. It also possesses the second highest population in the world. Given the circumstances, India's

wildlife is under considerable threat. In fact, it has been continuously declining for the past century or so. The Royal Bengal Tiger, for instance, whose numbers hovered around one lakh at the start of the 20th century had seen its population plummet to just over 1,400 in 2006. Today with sustained effort the number is estimated to be close to 3,000.

India is host to 4 biodiversity hotspots and is home to numerous endemic species: the Western Ghats, the Himalayas, the Indo-Burma region and the Sundaland. In India, there are 372 species of mammals many of whom, have gradually become a part of the culture and are often associated with deities. Some of the well-known large mammals include the Asiatic lion, Asian elephant, Bengal tiger and Indian rhinoceros. Feline species in India, apart from lion and the tiger, include rare species like snow leopard, clouded leopard and the marbled cat.

A total of 1,228 known bird species are found in India. Some of the prominent ones are peacocks, parakeets, cranes, mynahs, pheasants, geese and hornbills. We have 446 reptile species in India including crocodiles and gharials.

The expansion and growth of human population has put many species at risk. A total of 77 mammals, 72 bird species, 17 reptile species, 3 amphibian species and many others are endangered now.

We have completely lost some of our species such as the Indian Cheetah and have managed to just about save the Asiatic Lion from the brink of extinction. In light of all this, several plans have been put in place by the Government of India to preserve the remaining biodiversity.

Protected areas

Protected areas are regarded as the chief means of conservation all around the world. In India around 157,000 square kilometres are protected, which is around 4.95% of the total land area. They are classified into several genres - protected and reserved forests, wildlife sanctuaries, national parks and biosphere reserves.

The 103 national parks in India are of greatest importance at this time as they contain most of the endangered species. Jim Corbett National Park was the first of these. These national parks are spread all over India and have the dual role of protecting the flora and fauna as well as raising money for conservation through tourism. Most of these are guarded by a network of forest guards. However, often these guards are massively disadvantaged in terms of weapons and numbers when compared to poachers. This has meant that even the national parks are not fully fledged safe havens for wildlife.

Of equal importance to national parks are the biosphere reserves. Some of the major biosphere reserves of India are the Nilgiris, the Sundarbans, Great Nicobar, Nanda Devi and Pachmarhi. The biosphere reserves often comprise of more than one national parks and wildlife sanctuaries and are known to contain enormous biodiversity as well as a population

of endemic species. These reserves serve to protect both wildlife as well as the traditional human settlement residing in the region.

Wildlife sanctuaries are areas which have comparatively lower biodiversity and are of lesser importance from a conservation point of view. India currently has over 500 wildlife sanctuaries some of which form the fringes of major national parks. The importance of these sanctuaries is being re-evaluated in recent times. They are important in forming corridors connecting national parks as well as in forming buffer areas around them. Moreover, they can be important to prevent species from local extinction.

Project Tiger

Project Tiger was launched in the year 1973 under the Indira Gandhi regime, when it was felt that the current conservation means are insufficient to preserve the rapidly dwindling tiger numbers. As part of this initiative, some of the national parks and wildlife sanctuaries possessing a large population of tigers were designated as tiger reserves. The current number of such tiger reserves stands at 50.



Each of these tiger reserves has a buffer area surrounding the core area, with human activity being completely banned from the core area. The initiative also made provisions to facilitate

the relocation of human settlement away from the protected areas. It also launched a special tiger protection force to curb poaching activities.

The plan however has faced several stumbling blocks on the way, chief among them being issues faced in the relocation of human settlements and the question of tribal people's rights over forest land, something which is guaranteed to them by constitutional provisions.

Project Elephant

In light of the relative success of the Project Tiger, the Indian Government launched Project Elephant to protect another of its flagship species – the Indian elephant. However, protection of elephants has its own unique set of challenges. Prime among these challenges is the fact that unlike tigers, which are territorial, elephants are migratory in nature. And their migratory pattern is rather fixed they tend to use the same routes year after year. While individual forest reserves are relatively well protected, the corridors connecting them have been encroached upon by human activity.

Hence, the Project Elephant began with the 3-fold objective of preserving their natural habitat, preserving and creating natural corridors and reducing man-animal conflict. At the same time, it also introduced a scheme to easily compensate farmers affected by elephant activity and increased surveillance to deter poachers.

More than 32 elephant reserves encompassing 58,000 sq. km of area have been set up.



Indian elephants are smaller than their African counterparts.

Relocation plans

Apart from conservation of existing species, there have been ambitious plans to revive the population of extinct and locally extinct species, as is the case of Asiatic Lions. Currently, the Gir forests of Gujarat are the large refuge of these lions. However, these lions remain under constant threat of extinction due to low genetic diversity and limited habitat. Hence, there

have been plans to relocate some of these lions to a different habitat in Uttar Pradesh or Madhya Pradesh.

There have been reintroduction successes elsewhere. When the natural population of Sariska tiger reserve died, tigers were reintroduced from Ranthambore National Park, a move that has been largely successful. Similar plans involving rhinoceros have also proved fruitful.

Apart from these, there are several other ambitious projects such re-introduction of a population of African Cheetahs to replicate now extinct Indian cheetah population.

National Parks in India

India's first national park to be set up was Hailey's National park, now known as Jim Corbett National Park, in 1936 in Uttarakhand. The need to protect wildlife in India prompted the government to bring federal legislations and as a result, we have 103 national parks as of July 2017. Some of the prominent national parks are given below:

- Jim Corbett National Park: Named after Jim Corbett, who played a key role in its establishment, is situated in Nainital district of Uttarakhand. It is divided into four zones – Durgadevi, Dhikala, Jhirna, Birjani – and spans an area of 520 sq kms. It is one of the thirteen protected areas covered under the Terai Arc Landscape Program of WWF which aims to link these 13 areas of Nepal and India to enable wildlife migration.
- 2. Kaziranga National Park: This UNESCO World Heritage Site is located in Assam and hosts two-thirds of the world's 'great one-horned rhinoceros'. It also has the highest density of tigers among protected areas in the world. Lord Curzon, Viceroy of India, and his wife Mary Curzon are credited for initiating the movement to protect this area.
- 3. Gir National Park: It is located in Gujarat and was established in 1965 prior to which it was used by kings and British officers for their hunting expeditions. This is the only area in Asia where Asiatic lions are found.
- 4. Sundarban National Park: It is located in West Bengal and is a part of the Sundarbans on the Ganges delta. Declared as a tiger reserve in 1973, this park is known for its signature mangrove forests. It became a UNESCO World Heritage Site in 1987.
- 5. Kanha National park: One of the tiger reserves of India, this is the largest national park in Madhya Pradesh. It was created in 1955 and was designated as a tiger reserve in 1973. It is also known for species such as sloth bear, barasingha and Indian wild dog.
- 6. Ranthambore National Park: Originally established as 'Sawai Madhopur Game Sanctuary' in 1955, this park is situated in Rajasthan. It was declared as a tiger reserve in 1973.
- 7. Keoladeo National Park: Formerly known as Bharatpur Bird Sanctuary, it was established in Rajasthan in 1982. It is a UNESCO World Heritage Site and home to 366 rare bird species.

- 8. Nanda Devi National Park: It was established in 1988 and is situated around the Nanda Devi peak in Uttarakhand. It is a world heritage site and is a part of 'Nanda Devi and Valley of Flowers National Parks'.
- 9. Hemis National Park: Located in the Leh district of Jammu and Kashmir, it was established in 1981. Globally famous for its snow leopards, it is the largest notified protected area in India.
- 10. Bandipur National Park: It was established in the state of Karnataka in 1974 as a tiger reserve. It is known for vulnerable species like Indian elephants, golden jackals, Indian rock pythons and four-horned antelopes.

Some of the species found in India







Notable environmentalists in India

Salim Ali

Known as the 'Birdman of India', he was born in Bombay (now Mumbai) in 1896 and was one of the greatest ornithologists and naturalists of all time. He was the first to carry out systematic bird surveys in India and abroad. He played a key role in creation of Bharatpur bird sanctuary and continuously worked towards the protection of the environment. He was awarded the Padma Bhushan in 1958 and Padma Vibhushan in 1976. He died on 20th June 1987.

Sundarlal Bahuguna

Born in Uttarakhand in 1927, he is a noted Garhwali environmentalist known for leading the Chipko movement. He dedicated his life for the protection of forests in the Himalayas. He also spearheaded the anti-Tehri dam movement in the early 1980s. He was awarded the Padma Shri in 1981, which he politely refused, and Padma Vibhushan in 2009.

'Billy' Arjan Singh

He was born in Gorakhpur, UP in 1917. He was an Indian hunter turned conservationist and author. He was the first to try to reintroduce tigers and leopards from captivity into the wild. He played a key role in transforming Dudhwa into a national park and was awarded the Getty Award from the World Wildlife Fund. He died on 1st January, 2010.

Romulus Whitaker

Born on 23rd May, 1943, he is an Indian herpetologist and wildlife conservationist. Founder of the Madras Snake Park and Madras Crocodile Bank Trust, he is known for his extensive study on king cobras and their habitat and was awarded the Padma Shri in 2018.

Jim Corbett

Born on 25th July, 1875, he was a British hunter, tracker and conservationist. He is known for setting up Hailey's National Park, now Jim Corbett National Park, which was India's first National Park. He tracked and shot a number of leopards and tigers who had turned into man-eaters. He authored numerous books, including the famous *The Man-Eater of Kumaon*, recounting his hunts and experiences. He died on 19th April, 1955, in Kenya.

Current and Future Status of Wildlife in India

In the past few decades, conservation in India has made rapid strides. In spite of several challenges we have been able to fend off many extinctions, with the extinction of Asiatic Cheetah being the only unnatural extinction recorded in India.

However, several challenges await India's wildlife in this century. India's population is expected to touch 1.5 billion in the next few decades. This would mean an even more severe tussle for space with wildlife.

However, based on current progress, we can see that there is hope for the preservation of environment and wildlife in India. There is a growing affinity for the wild among India's youth and this sentiment will definitely be translated into conservation on the ground.