

Chapter-17

BIODIVERSITY HOT SPOTS AND ENDEMISM

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Introduction

India is a megadiverse country having only 2.4% of the world's land area and 7-8% of all recorded species. India ranks 8th in the world and 4th in Asia among the megadiverse countries in the world. India is also a home of traditional crop varieties ranking first amongst the 12 regions of diversity of crop plants and seventh in the contribution of agricultural species. Globally, India holds the eighth position for origin and diversity of crop plants. Biodiversity hotspots are areas with a high diversity of locally endemic species, which are species that are not found or are rarely found outside the hotspot. The concept of biodiversity hotspots was given by Norman Myers. Of the 36 global biodiversity hotspots, four are present in India *i.e.* the Himalaya, the Western Ghats, the North-east, and the Nicobar Islands. India which is majorly found in the Western Ghats. Inventories of both floral and faunal diversities are progressively updated with many discoveries of new species through continuous survey and exploration. The 1992 Earth Summit held at Rio de Janeiro led to the adoption of an internationally binding legal instrument, the Convention on Biological Diversity (CBD) during the United Nations Conference on Environment and Development (UNCED) with the objectives of conservation, sustainable use and fair and equitable sharing of benefits arising from the use of biological diversity. Consequently, India enacted the Biological Diversity (BD) Act in 2002 and notified the Biological Diversity Rules in 2004. A three-tier institutional structure was formed for implementation of the Biological Diversity Act 2002, wherein the apex body, the National Biodiversity Authority (NBA) headquartered in Chennai was established in 2003 under Section 8 of the Act to implement the Biological Diversity Act at the national level. An important limitation of the biodiversity hotspot concept is that there may be species highly threatened with extinction that do not occur within what has traditionally been classified as a hotspot. Climate velocity, the direction and pace of movement in climate variables (typically temperature) in space, is key to understanding the origin and fate of biodiversity hotspots under climate change.

What is Endemism?

The term 'endemism' was coined by A.P. de Candolle (1855) for the distribution of an organism (plant, animal or microorganism) in a limited geographical area. In Ecological terms, it states that a plant or an animal lives only in a particular location, such as a specific island, habitat type, nation or other defined zone. It is the association of a biological taxon with a unique and well-defined geographic area. The cosmopolitan distribution or cosmopolitan is the antithesis of endemic, and refers to a taxon which is extremely widespread in many world regions. Two general classes of endemism are widely recognized: Paleoendemism and Neoendemism.

- **Paleoendemic species:** Paleoendemism means "ancient endemics" these are the organisms (animals or plants) that are restricted to an area because they have died out elsewhere. A fossil record elsewhere is the best evidence for paleoendemism (e.g., in Sequoia, Sequoiadendron, Lyonothamnus). These are also described as those species which used to live in a large area in the

past, but now live only in a smaller area.

- **Neoendemic species:** Neoendemism means that a species has recently appeared which is closely related to the main species or one that has formed following hybridization and is now classified as a separate species. This is a common process in plants especially those which exhibit polyploidy. These species result from the divergent adaptation to differing environmental conditions, thereby, leading to the formation of new species that are locally distributed. The evolution of neoendemic plant species is often triggered by polyploids. The endemic species may have a higher ploidy level than its related taxa (apoendemics), or it may be diploid while its related taxa have a higher ploidy level (patroendemics). In cases where the endemic taxon and its related taxa are of equal ploidy level, the endemic species are called schizoendemics. Apo-, patro-, and schizoendemics are further subdivisions of neoendemic.

Habitat for Endemism

The territory where a species lives is called its distribution, it describes that where in the world that species naturally occurs. Therefore, based on their habitat of distribution on entire globe species can be cosmopolitan, endemic or disjunct. For example, the distribution of polar bears restricted to Arctic region and lemurs occur naturally only in the Island of Madagascar region is consider as the endemic species of that particular region. Another example of endemic species is Bay checkerspot butterfly *i.e.* *Euphydryas editha bayensis* occurring in only one region in the San Francisco Bay area. In contrast to this, brown rats (*i.e.* *Rattus norvegicus*), occurring everywhere, are considered as cosmopolitan species.

Characteristics of Endemism

- They are localized in distribution because of their narrow ecological amplitude and are unable to invade in fresh areas.
- They lack potentially to migrate because of saturate genomes.
- Real endemics never migrate while Neo-endemics have the potential to migrate.
- The dispersal propagules are not able to sustain during migration to other area. It may be due to physical barriers.

Biodiversity Hotspots in the World(36)

- 1. Tropical Andes (South America)
- 2. Mesoamerica (North & Central America)
- 3. The Caribbean Islands (The Caribbean)
- 4. The Atlantic Forest (South America)
- 5. Tumbes-ChocóMagdalena (South America)
- 6. The Cerrado (South America)
- 7. Chilean Winter Rainfall-Valdivian Forests (South America)
- 8. The California Floristic Province (North and Central America)
- 9. Madagascar and the Indian Ocean Islands (Africa)
- 10. The Coastal Forests of Eastern Africa (Africa)
- 11. The Guinean Forests of West Africa (Africa)
- 12. The Cape Floristic Region (Africa)
- 13. The Succulent Karoo (Africa)
- 14. The Mediterranean Basin (Europe)
- 15. The Caucasus (West Asia)
- 16. Sundaland (South East Asia and Asia Pacific)
- 17. Wallacea (South East Asia and Asia Pacific)
- 18. The Philippines (South East Asia and Asia Pacific)
- 19. Indo-Burma Eastern Himalayas (South Asia)
- 20. The Mountains of Southwest China (East Asia)
- 21. Western Ghats and Sri Lanka (South Asia)
- 22. Southwest Australia (South East Asia and Asia-Pacific)
- 23. New Caledonia (South East Asia and Asia-Pacific)
- 24. New Zealand (South East Asia and Asia-Pacific)
- 25. Polynesia and Micronesia (South East Asia and Asia-Pacific)
- 26. The Madrean Pine-Oak Woodlands (North and Central America)
- 27. Maputaland-Pondoland Albany (Africa)
- 28. The Eastern Afromontane (Africa)
- 29. The Horn of Africa (Africa)
- 30. The Irano-Anatolian (West Asia)
- 31. The Mountains of Central Asia (Central Asia)
- 32. Eastern Himalaya (South Asia)
- 33. Japan (East Asia)
- 34. East Melanesian Islands (South East Asia and Asia-Pacific)
- 35. Eastern Australian temperate forests (South East Asia and Asia-Pacific)

Theories of Endemism

There are two main theories of Endemism. The first theory believes that the last survivors of once flourishing flora which is now declining are the relics or epibiotics which are endemics. However, second theory believes that these are recent and youthful forms in course of gradual extinction. According to Willis age-and-area hypothesis, most endemic species are considered to be youthful i.e. youngsters rather old relic. The concept of endemism includes two types of organisms whose areas are confined to a single regions: endemics (which are relatively youthful species), and epibiotics (which are relatively old relic species). The theory is also known as Age and Area hypothesis. The first theory is supported by Geographers e.g., *Sequoia semipenirens* of the central Valley of California and Oregon and *S. gigantea* of Sierra Nevada which are endemic to their respective native homes, were extensively distributed in Cretaceous and Tertiary periods. The supporters of second theory have the examples of *Primula*, *Impatiens* and *Rhododendron* etc. According to this theory, Area is directly proportional to its age in the scale of evolution. So, a small area of distribution shows relatively young in age e.g., *Coleus* is distributed on the summit of the dry Ritigala mountains in Sri Lanka, with two species *C. elongatus* and *C. barbatus*. *C. elongatus* is endemic and *C. barbatus* is widely distributed in tropical Asia and Africa. Willis believed *C. elongatus* to be derived from *C. barbatus*.

Factors Responsible for Endemism

- Factors responsible for the production of endemics are natural crossing among the closely related plants growing under favorable conditions and Mutations. If the condition of isolation is developed the effect becomes more pronounced.
- Endemism is found in isolated e.g., islands, isolated areas etc. Mountains also have more endemic species as they are isolated e.g., 70% sp. of Himalayas is endemic.
- Climate also is one of the factors e.g., North of Himalaya is dry plateau of Tibet and South Himalayan range has alluvial fertile soil. According to Chatterjee the percentage of endemic species of Dicot plants in India is more than 50. Maximum endemic plants are found in the Himalayas and South India. Indo-Gangetic plains have a very small number of endemic species.

Endemism in India

- In India, there are following four mega endemic centres:
- **Indo-Burma** covering Mizoram, Manipur, Nagaland, Meghalaya, Tripura and Andaman Islands
- **Himalaya** covering Jammu & Kashmir, Himachal Pradesh, Uttarakhand, northern part of West Bengal (Darjeeling), Sikkim, northern part of Assam and Arunachal Pradesh.
- **Western Ghats** falls within the states of Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat.
- **The Sundaland** covering the Nicobar Islands.
- Peninsular India is the richest endemic centre. It harbors nearly 82% of the total endemic genera of the country. Peninsular India has a high concentration of endemic genera (40 genera).
- There is no endemic family in India. There are only 49 genera endemic to India, of which 36 are unspecific.
- Hill tops provide a good environment for endemism next to islands.
- The species richness and high endemism in the Western Ghats is due to varied latitudinal and altitudinal gradients with varied rainfall and temperature.
- Some examples of endemic plant species of India are *Rhododendron* sp. (Ericaceae), *Beaumontia grandiflora* (Apocynaceae), *Eleusine coracana* (Poaceae), *Caryota urens* (Arecaceae), *Aegle marmelos* (Rutaceae), *Crotalaria juncea* (Fabaceae), *Ficus religiosa* (Moraceae), and *Seasamum indicum* (Pedaliaceae) and other plant species belong to families like Rubiaceae (6 genera), Rosaceae, Asteraceae, Primulaceae and Acanthaceae etc.

- Some examples of the endemic animal species found in India are Lion-tailed macaque, Nilgiri Langur, Brown palm civet and Nilgiri tahr.

What are Bio-diversity Hot Spots?

Biodiversity hotspots are geographic areas with an exceptionally high richness of species, including rare and endemic species. Such hotspots have deep evolutionary roots and are concentrated in areas where past climatic variability was moderate. The British biologist Norman Myers coined the term “biodiversity hotspot” in 1988 as a biogeographic region characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. In 1990, Myers proclaimed eight hotspots, including four Mediterranean-type ecosystems. Conservation International (CI) adopted hotspots of Myers as its institutional blueprint in 1989 and in 1996. Conservation International (CI) is an American non-profit environmental organization which headquarter is situated in Arlington, Virginia (USA). Its goal is to protect nature as a source of food, fresh water, livelihoods and a stable climate. According to CI, to qualify as a hotspot, a region must meet two strict criteria

- an area must contain 0.5% of global total of vascular plants (estimated as 300,000 species) or 1500 species as endemics.”
- If an area having 15000 species of vascular plant (0.5% of 300,000 species) and or 1500 endemic species is under a major degree of threat such as 70% or more species have lost in recent past from that area – then we call this area as Hot spot.

In 1999, CI identified 25 biodiversity hotspots in the book “Hotspots: Earth’s Biologically Richest and Most Endangered Terrestrial Eco-regions”. Currently, 36 biodiversity hotspots have been identified, most of which occur in tropical forests. They represent just 2.3% of earth’s land surface, but between them they contain around 50% of the world’s endemic plant species and 42% of all terrestrial vertebrates. Overall, Hotspots have lost around 86% of their original habitat and additionally are considered to be significantly threatened by extinctions induced by climate change.

- **Biodiverstiy Hotspots in Africa:** A total of 08 Hotspots in African continent hold a diversity of plant and animal life, many of which are found nowhere else on Earth.
- **Biodiverstiy Hotspots in Asia-Pacific:**Composed of large land areas as well as islands dotting the Pacific seas, these 14 Hotspots represent important biodiversity.
- **Biodiverstiy Hotspots in Europe and Central Asia:**From the Mediterranean Basin to the Mountains of Central Asia, 4 Hotspots are unique in their diversity
- **Biodiverstiy Hotspots in North and Central America:** North and Central America play host to thousands of acres of important habitat and cover 4 hotspots of diversity.
- **South America:**From Brazil’s Cerrado to the Tropical Andes, South America has some of the richest and most diverse life on Earth and cover 5 hotspots of diversity.

What are Hottest Hotspots?

Some hot spots are much richer than others in terms of their numbers of endemic species. These are called hottest hotspots. They are considered by five key factors i.e. numbers of endemics and endemic species/area ratios for both plants and vertebrates, and habitat loss. Eight hottest hotspots of biodiversity in the world are as follows

1. Madagascar
2. Philippines
3. Sundaland
4. Brazil’s Atlantic forests
5. Caribbean island
6. Indo – Burma region
7. Western Ghats & Srilanka
8. Eastern arc & coastal forests of Tanzania/Kenya

The leaders are Madagascar, the Philippines and Sundaland, appearing for all five factors, followed by Brazil’s Atlantic Forest and the Caribbean, appearing for four.

Who are Megadiverse countries?

The concept of Megadiverse countries was first given by Russell Mittermeier in 1988. It is based on the total number of species in a country and the degree of endemism at the species level and at higher taxonomic levels. Based on an analysis of primate conservation priorities, he found that four countries accounted for two-thirds of all primate species. The analysis was then expanded to include other mammals, birds, reptiles, amphibians, plants and selected groups of insects. These countries representing majority of tropical rainforests, coral reefs and other priority systems. The results of the assessment were published in the *Megadiversity: Earth's biologically wealthiest nations* (Mittermeier, Gil and Mittermeier eds. 1997. Cemex, Mexico). The World Conservation Monitoring Centre recognized 17 megadiverse countries in July 2000 including: 1. Australia, 2. The Congo, 3. Madagascar, 4. South Africa, 5. China, 6. India, 7. Indonesia, 8. Malaysia, 9. Papua New Guinea, 10. Philippines, 11. Brazil, 12. Colombia, 13. Ecuador, 14. Mexico, 15. Peru, 16. United States, 17. Venezuela. This group of countries has less than 10% of the global surface, but support more than 70% of the biological diversity on earth.

Biodiversity Hotspots in India

Four biodiversity hot spots are found in India. These are as follows

1. Himalaya

Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar)

Himalaya hotspot is home to the world's highest mountains including world's highest mountain peak, Sagarmatha (Mt. Everest) along with all of the world's mountain peaks higher than 8,000 meters. It is divided into Western Himalaya and Eastern Himalaya

- 1. Western Himalaya:** The Western Himalaya, covers, the Kumaon-Garhwal, northwest Kashmir, and northern Pakistan. It has diversity of ecosystems that range from alluvial grasslands and subtropical broadleaf forests along the foothills to temperate broadleaf forests in the mid hills, mixed conifer and conifer forests in the higher hills, and alpine meadows above the tree line. Vascular plants have even been recorded at more than 6,000 m.
- 2. The Eastern Himalaya:** The Eastern Himalaya, covers parts of Nepal, Bhutan, the northeast Indian states of West Bengal, Sikkim, Assam, and Arunachal Pradesh, southeast Tibet, and northern Myanmar. The Eastern Himalaya is also a center of diversity for several widely distributed plant taxa, such as *Rhododendron*, *Primula*, and *Pedicularis*. In the Himalaya Hotspot, a zone of permanent rock and ice begins at about 5,500–6,000 m; in spite of these harsh conditions, there are records of vascular plants occurring at some of the highest elevations on Earth. Cushion plants have been recorded at more than 6,100 m, while a high-altitude scree plant in the mustard family, *Ermania himalayensis*, was found at 6,300 m on the slopes of Mt. Kamet in the northwestern Himalayas.

Biodiversity and Endemism in Himalaya Hot Spot

The Himalaya hotspot is home to populations of numerous large birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalo. Of the estimated 10,000 species of plants in the Himalaya hotspot, about 3,160 are endemic, as are 71 genera. Furthermore, five plant families (*Tetracentraceae*, *Hamamelidaceae*, *Circaesteraceae*, *Butomaceae* and *Stachyuraceae*) are endemic to the region. The largest family of flowering plants in the hotspot is the *Orchidaceae*, with 750 species, and a large number of orchids. The Himalayan hotspot has nearly 163 globally threatened species (both flora and fauna) including the One-horned Rhinoceros [Vulnerable], the Wild Asian Water buffalo [Endangered]. The area has long been recognized as a rich centre of primitive flowering plants and is popularly known as the 'Cradle of Speciation'. Species of several families of monocotyledons, *Orchidaceae*, *Zingiberaceae* and *Arecaceae* are found in the area. Gymnorperms and Pteridophytes (ferns) are also well represented here. The area is also rich in wild relatives of plants of economic

significance e.g. rice, banana, citrus, ginger, chilli, jute and sugarcane. It is also regarded as the centre of origin and diversification of five palms of commercial importance, namely coconut, arecanut, palmyra palm, sugar palm and wild date palm. Tea (*Thea sinensis*) has been cultivated in this region for the last 4,000 years. Many wild and allied species of tea, the leaves of which are used as a substitute for tea, are found in the North East, in their natural habitats. The Taxol plant (*Taxus wallichiana*) is sparsely distributed in the region and is listed under the red data category due to its overexploitation for extraction of a drug effectively used against cancer. A few threatened endemic bird species such as the Himalayan Quail, Cheer pheasant, Western tragopan are found here, along with some of Asia's largest and most endangered birds such as the Himalayan vulture and White-bellied heron. Mammals like the Golden langur, The Himalayan tahr, the pygmy hog, Lang-urs, Asiatic wild dogs, sloth bears, Gaurs, Muntjac, Sambar, Snow leopard, Black bear, Blue sheep, Takin, the Gangetic dolphin, wild water buffalo, swamp deer call the Himalayan ranged their home.

Threats to Biodiversity in Himalaya Hot Spot

Habitat destruction, habitat fragmentation, deforestation and overgrazing are the major threats to biodiversity in Himalaya hot spot. In addition to habitat loss and degradation poaching is a serious problem in the Himalayan Mountains, with tigers and rhinoceros hunted for their body parts for traditional Chinese medicine, while snow leopards (*Uncia uncia*, EN) and red pandas (*Ailurus fulgens*, EN) are sought for their beautiful pelts. Other threats to biodiversity and forest integrity include mining, the construction of roads and large dams, and pollution due to the use of agrochemicals.

2. Indo-Burma

Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)

A wide diversity of ecosystems is represented in this hotspot, including mixed wet evergreen, dry evergreen, deciduous, and montane forests. There are also patches of shrublands and woodlands on karst limestone outcrops and, in some coastal areas, scattered heath forests. In addition, a wide variety of distinctive, localized vegetation formations occur in Indo-Burma, including lowland floodplain swamps, mangroves, and seasonally inundated grasslands. Indo-Burma is still revealing its biological treasures. Six large mammal species have been discovered in the last 12 years: the large-antlered muntjac, the Annamite muntjac, the grey-shanked douc, the Annamite striped rabbit, the leaf deer, and the saola. This hotspot also holds remarkable endemism in freshwater turtle species, most of which are threatened with extinction, due to over-harvesting and extensive habitat loss. Bird life in Indo-Burma is also incredibly diverse, holding almost 1,300 different bird species, including the threatened white-eared night-heron, the grey-crowned crocias, and the orange-necked partridge. Among the flora of the Indo-Burma Hotspot are a wide array of orchid and ginger species (there are more than 1,000 orchid species in Thailand alone) and many tropical hardwood trees, including commercially valuable dipterocarp species and teak (*Tectona grandis*).

Biodiversity and Endemism in Indo-Burma Hot Spot

This region is home to several primate species such as monkeys, langurs and gibbons with populations numbering only in the hundreds. Many of the species, especially some freshwater turtle species, are endemic. Almost 1,300 bird species exist in this region including the threatened white-eared night-heron [Endangered], the grey-crowned crocias [Endangered], and the orange-necked partridge [Near Threatened]. It is estimated that there are about 13,500 plant species in this hotspot, with over half of them endemic. A wide array of orchid and ginger species (there are more than 1,000 orchid species in Thailand alone) and many tropical hardwood trees, including commercially valuable dipterocarp species and teak (*Tectona grandis*).

Threats to Biodiversity in Indo-Burma Hot Spot

Indo-Burma is one of the most threatened biodiversity hotspots, due to the rate of resource exploitation and habitat loss. Indo-Burma was one of the first places where humans developed agriculture, and has a long history of using fire to clear land for agriculture and other needs. Other threats to forests include logging, mining for gems and ore, firewood collection, and charcoal production. Aquatic ecosystems are also under intense development pressure in many areas. Freshwater floodplain swamps and wetlands are destroyed by draining for wet rice cultivation, particularly in Thailand, Myanmar and Vietnam. Mangroves have been converted to shrimp aquacultural ponds, while intertidal mudflats have been extensively afforested with mangrove or intensely fished by lines of stack nets, which severely impacts their value as feeding habitat for migratory water birds and other species. Moreover, sand dune ecosystems are severely threatened by afforestation, for instance, with the Australian exotic *Casuarina equisetifolia*. Finally, overfishing and the increasing use of destructive fishing techniques is a significant problem in both coastal and offshore marine ecosystems. The Chinese demand for turtles, snakes, tigers, and other species has depleted populations to the brink of extinction in just a few years. The volume of trade in turtles is astounding, with over ten million individuals exported to China from Southeast Asia each year.

3. Sundaland

Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)

Sundaland is bordered by three hotspots. The boundary between the Sundaland Hotspot and the Indo-Burma Hotspot to the northwest is the Kangar-Pattani Line, which crosses the Thailand-Malaysia border. Wallacea lies immediately to the east of the Sundaland Hotspot separated by the famous Wallace's Line, while the 7,100 islands of the Philippines Hotspot lie immediately to the northeast. Lowland rainforests are dominated by the towering trees of the family Dipterocarpaceae. Sandy and rocky coastlines harbor stands of beach forest, while muddy shores are lined with mangrove forests, replaced inland by large peat swamp forests. In some places the ancient uplifted coral reefs support specialized forests tolerant of the high levels of calcium and magnesium in the soils. Infertile tertiary sandstone ridges support forest. Higher elevations boast montane forests thick with moss, lichens, and orchids, while further up, scrubby subalpine forests are dominated by rhododendrons. At the very tops of the highest mountain peaks, the land is mostly rocky and without much vegetation. Some of the last refuges of two Southeast Asia rhino species are also found on the islands of Java and Sumatra. Like many tropical areas, the forests are being cleared for commercial uses. Rubber, oil palm, and pulp production are three of the most detrimental forces facing biodiversity in the Sundaland Hotspot.

Biodiversity and Endemism in Sundaland Hot Spot

Sundaland is one of the biologically richest hotspots on Earth. The United Nations declared the islands a World Biosphere Reserve in 2013. It is a region in South-East Asia that covers the western part of the Indo-Malayan archipelago. It includes Thailand, Malaysia, Singapore, Brunei and Indonesia. India is represented by the Nicobar Islands. The islands have a rich terrestrial and marine ecosystem that includes mangroves, coral reefs and sea grass beds. It has about 25,000 species of vascular plants, 15,000 (60%) of which are found nowhere else. One plant family, the Scyphostegiaceae, is confined to the hotspot and is represented by a single tree species, *Scyphostegia borneensis* from Borneo. Notable plants in the hotspot include members of the genus *Rafflesia*, represented by 16 species with very large flowers. One of these, *Rafflesia arnoldii*, has the largest flowers in the world, measuring up to one meter in diameter. The marine biodiversity includes several species such as whales, dolphins, dugong, turtles, crocodiles, fishes, prawns, lobsters, corals and sea shells. The primary threat to this biodiversity comes from over exploitation of marine resources.

Threats to Biodiversity in Sundaland Hot Spot

The most significant threat facing Sundaland's biodiversity is forest destruction. Rapid road construction increases the extent and speed of deforestation, by providing access for loggers, settlers, and miners. In recent years, fires have become a major threat to the forests of Sundaland. One of the most insidious threats to the fauna of Sundaland is the wildlife trade. Orang-utan numbers were severely reduced in the past because of the pet trade. Today, tigers and rhinoceroses are the most visible targets of hunting for the Chinese medicine market, for skins, body parts, and horns. Turtles, snakes, geckos, pangolins, bear, and monkeys are exported by the ton from the region on a daily basis. Indonesia has long been the region's leading producer and exporter of snake leather. This trade has been surpassed in recent years by the export of live turtles to East Asia. Most turtle populations throughout the Sundaland hotspot are either in decline or have collapsed. Indonesia's massive cage bird trade has also placed a number of species such as Bali Starling and Straw-headed bulbul (*Pycnonotus zeylanicus*, VU) under serious threat. The latter species, once common across its range, is now confined largely to remote areas.

4. Western Ghats and Sri Lanka

Includes entire Western Ghats (and Sri Lanka)

The Western Ghats, known locally as the Sahyadri Hills, are formed by the Malabar Plains and the chain of mountains running parallel to India's western coast, about 30 to 50 kilometers inland. Sri Lanka is a continental island separated from southern India by the 20-meter-deep Palk Strait. Due to the varying effect of the yearly monsoons and the high mountain regions, this hotspot is home to a rich endemic assemblage of plants, reptiles, and amphibians. Sri Lanka alone may be home to as many as 140 endemic species of amphibians. The region also houses important populations of Asian Elephants, Indian Tigers, and the Endangered Lion-tailed Macaque. Freshwater fish endemism is extremely high as well, with over 140 native species.

Biodiversity and Endemism in Western Ghats and Sri Lanka Hot Spot

The wide variation of rainfall patterns in the Western Ghats, coupled with the region's complex geography, produces a great variety of vegetation types. Some prominent genera and families are represented by large numbers of endemic species, such as *Impatiens* with 76 of 86 species endemic, *Dipterocarpus* with 12 of 13 species endemic, and *Calamus* with 23 of 25 species endemic. Of the 490 tree species recorded from low and mid elevation forests, 308 species are endemic. The only gymnosperm tree, *Podocarpus* (*Nageia*) *wallichianus*, is also endemic. Of the 267 species of orchids, 130 are endemic. There are over 6000 vascular plants belonging to over 2500 genera in this hotspot, of which over 3000 are endemic. Much of the world's spices such as black pepper and cardamom have their origins in the Western Ghats. Nearly 235 species of endemic flowering plants are considered endangered. Similarly, plant diversity and endemism in Sri Lanka are quite high, with 3,210 flowering plant species in 1,052 genera, of which 916 species and 18 genera are endemic. Amazingly, all but one of the island's more than 55 dipterocarp species is found nowhere else in the world. In addition, the island's ferns (although not recently assessed) are estimated to number about 350 species. Approximately 433 plant species, and at least five genera, are confined to Sri Lanka and the Western Ghats combined. Rare fauna of the region include –Asian elephant, Nilgiri tahr, Nilgiri langur, Flying squirrel, Indian tigers, lion tailed macaque [All Endangered], Indian Giant squirrel [Least Concern], etc. The highest concentration of species in the Western Ghats is believed to be the Agasthyamalai Hills in the extreme south. The region also harbors over 450 bird species, about 140 mammalian species, 260 reptiles and 175 amphibians. Over 60% of the reptiles and amphibians are completely endemic to the hotspot. Remarkable as this diversity is, it is severely threatened today. The vegetation in this hotspot originally extended over 190,000 square kms. Today, it has been reduced to just 43,000 sq. km. In Sri Lanka, only 1.5% of the original forest cover still remains.

Threats to Biodiversity in Western Ghats and Sri Lanka Hot Spot

Human Impacts Extremely high population pressure in both countries of this hotspot has seriously stressed the region's biodiversity. Forests have been converted to agricultural land for monoculture plantations of tea, coffee, rubber, oil palm, teak, eucalyptus, and wattle, and are also cleared for building reservoirs, roads, and railways. Encroachment into protected areas further reduces the extent of forests. Grazing by cattle and goats within and near protected areas causes severe erosion on previously forested slopes. Much of the remaining forest cover consists of timber plantations or disturbed secondary growth. Today, approximately 20% of the original forest cover remains in more or less pristine state, with forest blocks larger than 200 km² found in the Agasthyamalai Hills, Cardamom Hills, Silent Valley- New Amarambalam Forests, and southern parts of the South Kannada District in Karnataka State. Remaining forest patches are subject to intense hunting pressure and the extraction of fuelwood and non-timber forest products. Uncontrolled tourism and forest fires are additional concerns. The growth of populations around protected areas and other forests has led to increasing human wildlife conflict. Raiding elephants cause crop loss, and leopards kill livestock. Compensation for farmers is generally inadequate, and wild animals are often killed or injured in an attempt to reduce further damage.

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