INDIANCIVILS *Sample Material*

CONTENTS

BIOLOGICAL DIVERSITY

Sample Material

Biological diversity, or biodiversity, is a term used to describe the myriad life forms found on Earth. These are the legacy of billions of years of evolution, shaped by natural processes and increasingly, by the activities of humans. Biodiversity is most often understood as the number of different species of plants, animals and microorganisms in existence. However, biodiversity also encompasses the specific genetic variations and traits within species as well as the assemblage of these species within ecosystems. At the genetic level, differences in DNA codes within species give rise to unique types including different varieties of crops and breeds of livestock. Ecosystems provide the basic necessities of life (e.g., food, water and the very air we breathe), offer protection from natural disasters and disease (e.g., by regulating climate, floods and pests), provide a foundation for human cultures and inspire our spiritual beliefs and worldviews. These "ecosystem services" also support and maintain the essential life processes of the planet, such as primary production and nutrient cycling. Each of these supporting services is essential to human well-being, whether the services are considered at the local or regional or global level.

Deep concern over the rapid loss of biodiversity and the realization that it plays a fundamental role in supporting human life motivated the creation of the Convention on Biological Diversity, a legally binding global treaty. Opened for signature at the Earth Summit Rio de Janeiro in 1992 and entering into force in 1993, the Convention arose from an international dialogue, begun a decade earlier by the World Commission on Environment and Development (known as the Brundtland Commission). The Convention is holistic covering all aspects of biodiversity, and was the first international treaty to acknowledge the role of biodiversity in sustainable development.

Convention encompasses three equally important and complementary objectives: the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

The seven focal areas in decision VII, adopted at the 2004 Conference of the Parties include:

1. Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems (ii) species and populations; and (iii) genetic diversity;
2. Promoting sustainable use of biodiversity;
3. Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution and habitat change;
4. Maintaining ecosystem integrity and the provision of goods and services provided by Biodiversity in ecosystems, in support of human well-being;
5. Protecting traditional knowledge, innovations and practices;
6. Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources; and
7. Mobilising financial and technical resources, especially for developing countries, in particular least developed countries and small island developing states among them, and countries with economies in transition, for implementing the Convention and the Strategic Plan.

Targets also form the core of the United Nations Millennium Development Goals, providing a commonly agreed focus for activities by all countries and stakeholder groups to meet the needs of the world's poorest people. Similarly, the Kyoto Protocol is centred on meeting targets for reducing greenhouse gas emissions.

COP 10 - Tenth meeting of the Conference of the Parties to the Convention on Biological Diversity Nagoya, Aichi Prefecture, Japan, 18 - 29 October 2010

COP 9 - Ninth meeting of the Conference of the Parties to the Convention on Biological Diversity Bonn, Germany, 19 - 30 May 2008

COP 8 - Eighth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Curitiba, Brazil, 20 - 31 March 2006

COP 7 - Seventh Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Kuala Lumpur, Malaysia, 9 - 20 February 2004

COP 6 - Sixth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, The Hague, Netherlands, 7 - 19 April 2002

COP 5 - Fifth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Nairobi, Kenya, 15 - 26 May 2000

ExCOP 1 - First Extraordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Cartagena, Colombia & Montreal, Canada, 22 - 23 February 1999 & 24 - 28 January 2000

COP 4 - Fourth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Bratislava, Slovakia, 4 - 15 May 1998

COP 3 - Third Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Buenos Aires, Argentina, 4 - 15 November 1996

COP 2 - Second Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Jakarta, Indonesia, 6 - 17 November 1995

COP 1 - First Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity, Nassau, Bahamas, 28 November - 9 December 1994

The *Cartagena Protocol on Biosafety to the Convention on Biological Diversity* is an international agreement which aims to ensure the safe handling, transport and use of living modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health. It was adopted on 29 January 2000 and entered into force on l1 September 2003.

As population pressures and consumption levels increase, biodiversity decreases, and the ability of the natural world to continue delivering the goods and services on which humanity ultimately depends may be undermined. Biodiversity underpins ecosystem functioning. The services provided by healthy ecosystems in turn, are the foundation for human well-being. These ecosystem services not only deliver the basic material needs for survival, but also underlie other aspects of a good life, including health, security, good social relations and freedom of choice. By disrupting ecosystem functions, biodiversity loss makes ecosystems more vulnerable to shocks and disturbances, less resilient, and less able to supply humans with needed services.

Millennium Development Goals

The Millennium Development Goals were agreed upon at the United Nations Millennium Summit in 2000. Under each Goal, specific targets for 2015 were established.

GOAL 1: Eradicate extreme poverty and hunger
GOAL 2: Achieve universal primary education
GOAL 3: Promote gender equality and empower women
GOAL 4: Reduce child mortality
GOAL 5: Improve maternal health
GOAL 6: Combat H1V/AIDS, malaria and other diseases
GOAL 7: Ensure environmental sustainability
GOAL 8: Develop a Global Partnership for Development

Millennium Ecosystem Assessment has already confirmed that the real costs of biodiversity loss pose a significant barrier to meeting the MDGs. Although policy-makers have generally focused narrowly on the contribution of biodiversity conservation and sustainable use to the achievement of Goal 7 ("Ensure environmental sustainability"), the wider role of ecosystem services in supporting livelihoods and human well-being reveals biodiversity to be the foundation for all development, and hence for meeting each of the Millennium Development Goals.

General patterns of change in the extent of ecosystems across other biomes besides forests show similar negative trends. The Millennium Ecosystem Assessment reported that almost 70% of Mediterranean forests, woodlands and scrubs, 50% of tropical and sub-tropical grasslands, savannas and shrub lands and 30% of desert ecosystems had been lost by 1990. Coastal and marine ecosystems have been heavily impacted by human activities, with degradation leading to a reduced coverage of kelp forests, sea grasses and corals. In the Caribbean, average hard coral cover declined from about 50% to 10%. In 1970s some 35% of mangroves have save been lost in the last two decades in countries for which, adequate data are available. This is equivalent to an annual loss of 2% of the remaining area. There has been a widespread retreat of mountain glaciers in non-polar regions during the 20th century, and decreases of about 10% in the extent of snow cover since the late 1960s. In the Arctic the average annual sea ice extent has declined by about 8% in the past 30 years, with a loss of 15 to 20% in summer sea ice extent over the same period.

HEADLINE INDICATOR

1. Species population trend indices are valuable tools for monitoring and communicating biodiversity change at global, regional and (sub-) national scales, or within biogeography units. They can also be applied to taxonomic groups (e.g. birds), habitat-dependent species (e.g. waterfowl) or species with particular ecological characteristics (e.g. migratory species). Trends in abundance and distribution of selected species are an indicator of ecosystem quality and complement the foregoing measures of ecosystem extent. Other indicators such as connectivity/fragmentation of ecosystems are also relevant in providing information about the quality of ecosystems. A number of assessments have revealed that, across range o f taxonomic groups, the population size and/ or geographic range of the majority of species assessed is declining. Studies of amphibians globally, African mammals, birds in agricultural lands, British butterflies, Caribbean and Indo-pacific corals, and commonly harvested fish species show declines in the majority of these species. Exceptions include species that have been protected through specific measures, that have had their specific threats reduced, and those that tend to thrive in modified landscapes.
2. Threatened species occur across all taxonomic groups and in all parts of the world. Over the past few hundred years, it is estimated that humans have increased species extinction rates by as much as 1.000 times the background rates typical over Earth's history. Between 12% and 52% of species within well-studied higher taxa are threatened with extinction, according to the IUCN Red List of Threatened Species.
3. From a human perspective, genetic diversity is of particular importance in cultivated and domesticated species. Only a relatively small number of species are used in this way: a few dozen domesticated animals, a few hundred crop plants (if ornamental plants are excluded) and a few dozen major plantation timber species. An analysis of trends in the varieties of species that underpin human livelihood, while sketchy, provides an alarming picture. Genetic variation is important for maintaining fitness and adaptability of species and of direct importance for people through the maintenance of goods and services provided by cultivated and domesticated species: high yields, disease resistance and resilience to changing environmental conditions, loss of genetic diversity is associated with the decline in population abundance and distribution that result from habitat destruction and fragmentation.
4. **Coverage of protected areas**: A key tool to counter the continuing loss of ecosystems and species is the establishment of protected areas. Protected areas currently cover about 12% of the Earth's land surface, constituting one of the largest planned changes of land use. Of more than 105,000 protected areas listed in the World Database on Protected Areas about 60% have a known date of establishment, there are substantial differences in coverage between different biomes, ecosystems and habitats. Only 5% of the world's temperate needle-leaf forests and woodlands. 4.4% of temperate grasslands and 2.2% of lake systems are protected. Moreover, marine-coverage lags far behind terrestrial coverage, with approximately 0.6% of the ocean's surface area and about 1.4% of the coastal shelf areas protected.
5. **Marine Trophic Index**: Oceans cover over 70% of the globe. The primary source of food from the oceans is from capture fisheries. Preferred fish catches consist of large, high value, predators fishes, as tuna, cod, sea-bass and swordfishes. The intensification of fishing has led to the decline in these fishes, which are high up in the food chain (e.g., in the North Atlantic, large fish have declined by thirds in the last 50 years). As predators are removed, the relative number of small fish and invertebrates lower on the food chain increases, and the mean trophic level (i.e., the mean position of the catch in the food chain) of fisheries landings, declines. In addition, the

resulting short food chains leave marine ecosystems increasingly vulnerable to natural-and human-induced stresses and reduce the overall supply of fish for human consumption.

6. **Connectivity/fragmentation of ecosystems:** In terrestrial and inland water ecosystems, human activities often lead to the fragmentation of habitats. Previously contiguous areas are divided into a number of smaller patches that are much more vulnerable to outside influence than large ones and that support smaller populations of species, which are consequently more vulnerable to local extinction. Global information on the status of anthropogenic fragmentation is available for large river systems and forests. In riverine systems, the creation of impoundments to form reservoirs, either for water storage or to generate hydroelectric power, have significant effects on the hydrology and water quality of the affected river system and its biodiversity, particularly that of migratory species. Catchments-scale impacts of dams on ecosystems stem from inundation, flow manipulation, and fragmentation. Known effects include the destruction of terrestrial ecosystems through inundation, greenhouse gas emission, sedimentation, an upsurge of nutrient release in new reservoirs, substantial changes in land-use patterns and an extensive modification of aquatic communities.
7. **Water quality in aquatic ecosystems**: Observations of physical, chemical and/or biological parameters over time indicate that the water quality of inland water bodies and their catchments has changed.' integrity of inland waters is affected by a series of factors, in particular the extraction of fresh water for agricultural, industrial and human consumption, and the physical alteration of the ecosystem, for example through the diversion and canalization of water courses, the creation of impoundments or drainage. Human activities are also impacting upon the quality of fresh water available, through pollution, increased-sedimentation and climate change. Inorganic nitrogen pollution of inland waterways, for example, has more than doubled since 1960 and has increased tenfold in many industrial parts of the world.

Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change

Five main threats to biodiversity are commonly recognized in the programmes of work of the Convention invasive alien species, climate change, nutrient loading and pollution, habitat change, and overexploitation. Unless we successfully mitigate the impacts of these direct drivers of change on biodiversity, they will contribute to the loss of biodiversity components, negatively affect ecosystem integrity and hamper aspirations towards sustainable use.

Promoting sustainable use of biodiversity

Area of forest, agricultural and aquaculture ecosystems under sustainable

1. **Management:** One of the headline indicators for assessing the sustainability of human use of biodiversity focuses on the proportion of area of forest, agricultural and aquaculture ecosystems under sustainable management. Global figures for such an indicator are currently not available.
2. **Ecological footprint and related concepts**: The ecological footprint is a widely known concept that aims to communicate unsustainable consumption. Using published statistics, it calculates the area of land and water needed to sustain a defined human population at a set material standard, based on the population's use of energy, food, water, building material and other consumables. Although the concept does not provide a comprehensive assessment of demands on nature, it is a useful accounting tool whose purpose is to demonstrate the effect of human consumption on the productive capacity of the Earth.

3. **Ensuring the fair and equitable sharing of benefits arising out of the use of genetic Resource**: The fair and equitable sharing of the benefits arising out of the utilization of genetic resources is one of three objectives of the Convention. These benefits would provide incentives to conserve and sustainable use biodiversity. Some countries have implemented legislation controlling access to genetic resources and there are a number of cases of benefit-sharing arrangements. However, there is no reliable central depositary of information on national access and benefit-sharing measures. Benefit sharing arrangements may involve some or all of the following: Governments, local and indigenous communities, private companies, non-governmental organizations and scientific research institutes.

The Ecosystem Approach

The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems. The Ecosystem Approach can be understood in terms of its 12 Principles and five points of operational guidance.

1. The objectives of management of land, water and living resources are a matter of societal choices.
2. Management should be decentralized to the lowest appropriate level.
3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
4. Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: a. Reduce those market distortions that adversely affect biological diversity; b. Align incentives to promote biodiversity conservation and sustainable use; c. Internalize costs and benefits in the given ecosystem to the extent feasible.
5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the Ecosystem Approach.
6. Ecosystems must be managed within the limits of their functioning.
7. The Ecosystem Approach should be undertaken at the appropriate spatial and temporal scales.
8. Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.
9. Management must recognize that change is inevitable.
10. The ecosystem approach should seek the appropriate balance between and integration of conservations and use of biological diversity.
11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
12. The Ecosystem Approach should involve all relevant sectors of society and scientific disciplines.

Five point of operational Guidance

I. Focus on the relationships and processes within ecosystem.
II. Enhance benefit-sharing.
III. Use adaptive management practices.
IV. Carry out management actions at the scale appropriate for the issue being addressed, with

decentralization to lowest level, as appropriate.

V. Ensure inter-sectoral cooperation.

AGRICULTURAL BIODIVERSITY

- Analyse the status and trends of the world's agricultural biodiversity.
- Identify management practices and technologies that promote the positive and mitigate the negative impacts of agriculture on biodiversity.
- Strengthen the capacities of farmers and indigenous and local communities to sustainably manage agricultural biodiversity.
- Develop national plans or strategies for the conservation and sustainable use of agricultural biodiversity.

BIOLOGICAL DIVERSITY OF DRY AND SUB-HUMID LANDS

- Assess the status and trends of biodiversity in dry and sub-humid lands
- Identify species areas of value for biodiversity
- Develop indicators of dry and sub-humid land biodiversity
- Build knowledge on ecological, physical and social processes affecting biodiversity
- Identify local and global benefits derived from dry and sub-humid land biodiversity
- Identify best management practices and promote measures for the conservation and sustainable use of biodiversity
- Support sustainable livelihoods

FOREST BIOLOGICAL DIVERSITY

- Apply the Ecosystem /Approach to forest management
- Reduce the threats to forest biodiversity
- Protect, recover and restore forest biodiversity
- Promote the sustainable use of forest biodiversity
- Promote the sharing of benefits resulting from the use of forest genetic resources
- Enhance the institutional enabling environment
- Address socio-economic failures and distortions
- Increase public education, participation and awareness
- Improve the assessment of forest biodiversity and understanding of ecosystem functioning
- Improve information management for assessment and monitoring

INLAND WATER BIODIVERSITY

- Integrate biodiversity into water-resource and river-basin management and relevant sectoral plans and policies
- Establish and maintain systems of protected inland water ecosystems
- Prevent the introduction of invasive alien species
- Encourage the application of low-cost technology and innovative approaches to water-resource management
- Provide incentives for the conservation and sustainable use of inland water biodiversity
- Develop an improved understanding of inland water biodiversity and the threats to inland water ecosystems

- Apply rigorous impact assessments
- Introduce monitoring arrangements for inland water biodiversity

MARINE AND COASTAL BIODIVERSITY

- Implement integrated marine and coastal area management (IMCAM)
- Promote the conservation and sustainable use of marine and coastal living resources
- Establish and maintain effective marine and coastal protected areas
- Prevent or minimize negative effects of Mariculture
- Prevent the introduction of invasive alien species

MOUNTAIN BIODIVERSITY

- Prevent and mitigate the impacts of key threats to mountain biodiversity
- Protect, recover and restore mountain biodiversity
- Promote the sustainable use of mountain biological resources
- Promote access to and sharing of benefits arising from the use of genetic resources
- Maintain genetic diversity in mountain ecosystems
- Enhance the legal, policy and institutional framework
- Preserve knowledge and practices of indigenous and local communities
- Establish regional and transboundary collaboration
- Improve identification, assessment and monitoring of mountain biodiversity
- Improve research, cooperation, technology transfer and other forms of capacity-building
- Increase public education, participation and awareness

ISLAND BIODIVERSITY

- Conserve and restore key terrestrial and marine ecosystems important for island biodiversity, societies and economies
- Establish national and regional systems of protected areas to conserve viable populations of selected island species
- Improve knowledge of and conserve the genetic material of significance to islands
- Prevent the movement of invasive alien species between and within islands and develop long-term management plans for priority species
- Implement climate change adaptation and mitigation measures in land-use and coastal zone planning and strategies.

THE BIODIVERSITY RELATED CONVENTION

Five international conventions focus on biodiversity issues: the Convention on Biological Diversity, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on the Conservation of Migratory Species of Wild Animals, the Ramsar Convention on Wetlands and the World Heritage Convention. The Convention on Biological Diversity is the most recent of these multilateral environmental agreements arising out of the Rio Earth Summit of 1992, some twenty years after Ramsar (1971), WHC (1972) and CITES (1975) entered into force, and ten years after CMS did (1983).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Through its three appendices, the Convention accords varying degrees of protection to more than 30,000 plant and animal species.

Endangered species: IUCN Red List refers to a specific category of threatened species and may include critically endangered species. *IUCN Red List of Threatened Species* uses the term *endangered species* as a specific category of imperilment, rather than as a general term. Under the IUCN Categories and Criteria, endangered species is between *critically endangered* and *vulnerable.* Also *critically endangered* species may also be counted as *endangered species* and fill all the criteria.

The more general term used by the IUCN for species at risk of extinction is *threatened species*, which also includes the less-at-risk category of vulnerable species together with endangered and critically endangered IUCN categories include:

- **Extinct**: Philippine Eagle, pictured in Davao City, Javan Tiger, Thylacine, Dodo, Passenger Pigeon, Caribbean Monk Seal, Dimetrodon, Aurochs, Dusky Seaside Sparrow.
- **Critically endangered**, faces an extremely high risk of extinction in the immediate future. Examples: Mountain Gorilla, Arakan Forest Turtle, Darwin's Fox, Javan Rhino, Brazilian Merganser, Gharial, Vaquita.
- **Endangered**: faces a very high risk of extinction in the near future. Examples: Dhole, Blue Whale, Bonobo, Ethiopian wolf, Giant Panda, Snow Leopard, African Wild Dog, Tiger, Indian Rhinoceros, three species of Albatrosses, Crowned Solitary Eagle, Philippine Eagle, Markhor, Orangutan, Grévy's zebra, Tasmanian Devil.
- **Vulnerable**: faces a high risk of extinction in the medium-term. Examples: Cheetah, Gaur, Lion, Sloth Bear, Manatee, Polar Bear, African Golden Cat, Komodo dragon, Golden hamster.
- **Conservation dependent**: The following animals are not severely threatened, but must depend on conservation programs. Examples: Spotted Hyena, Blanford's fox, Leopard Shark, Black Caiman, Killer whale.
- **Near threatened**: may be considered threatened in the near future. Examples: Blue-billed Duck, Solitary Eagle, Small-clawed Otter, Maned Wolf, Tiger Shark, Okapi.
- **Least concern**: no immediate threat to the survival of the species. Examples: nootka cypress, Wood Pigeon, White-tailed Mongoose, House Mouse, Wolverine.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS, or the Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. Parties to the CMS work together to conserve migratory species and their habitats by providing strict protection for the most endangered migratory species, concluding regional multilateral agreements for the conservation and management of specific species or categories of species, and undertaking cooperative research and conservation activities.

The Ramsar Convention on Wetlands (popularly known as the Ramsar Convention) provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention covers all aspects of wetland conservation and wise

use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of human communities.

The primary mission of the World Heritage Convention (WHC) is to identify and conserve the world's cultural and natural heritage by drawing up a list of sites whose outstanding values should be preserved for all humanity and ensuring their protection through closer cooperation among nations.

The governing bodies of each convention have set out specific mandates for cooperation among the biodiversity-related conventions and a number of joint work programmes have been established. To further enhance cooperation, a Biodiversity Liaison Group of biodiversity related conventions comprising the executive heads of those five conventions wits established in 2002.

BIODIVERSITY PROFILE OF INDIA

Sample Material

India, a mega diverse country with only 2.4 per cent of the land area, accounts for 7 - 8 per cent of the recorded species of the world, including over 45,500 species of plants and 91,000 species of animals.

India is situated at the tri-junction of the Afro-tropical, the Indo-Malayan and the Paleo-Arctic realms, which display significant biodiversity. India is one of the 17 identified mega diverse countries of the world. From about 70 per cent of the total geographical area surveyed so far, 45,500 plant species (including fungi and flower plants) and 91,000 animal species, representing about seven percent of the world's flora and 6.5 percent of the world's fauna, respectively, have been described. Nearly 6,500 native plants are still used prominently in the indigenous healthcare systems. From the biodiversity standpoint, India has some 59,353 insect species, 2,546 fish species, 240 amphibian species, 460 reptile species, 1,232 bird species and 397 mammal species, of which 18.4 per cent are endemic and 10.8 per cent are threatened. The country is home to at least 18,664 species of vascular plants, of which 26.8 per cent are endemic. With only 2.4 per cent of the total land area of the world, the known biological diversity of India contributes 8 per cent to the known global biological diversity. It has been estimated that at least 10 per cent of the country's recorded wild flora, and possibly the same percentage of its wild fauna, are on the threatened list, many of them on the verge of extinction.

India has two biodiversity hot spots, namely:
1. The Eastern Himalayas
2. The Western Ghats

And, it is composed of diverse ecological habitats:
1. Forests
2. Grasslands
3. Wetlands
4. Coastal and Marine ecosystems
5. Desert ecosystems

India, with varied terrain, topography, land use, geographic and climatic factors, can be divided into ten recognizable bio-geographic zones (*Rodgers et al., 2000*). These zones encompass a variety of ecosystems, mountains, plateaus, rivers, forests, deserts, wetlands, lakes, mangroves, coral reefs, coasts and islands.

Trans-Himalayan Region, constituting 5.6 per cent of the total geographical area, includes the high altitude, cold and arid mountain areas of Ladakh, Jammu & Kashmir, North Sikkim, Lahaul and Spiti areas of Himachal Pradesh. This zone has sparse alpine steppe vegetation that harbours several endemic species and is a favourable habitat for the biggest populations of wild sheep and goat in the world and other rare fauna that includes Snow Leopard (*Uncia uncia*) and the migratory Black necked Crane (Grus nigricollis). The cold dry desert of this zone represents an extremely fragile ecosystem.

Himalayan Zone, in the far North, constituting 6.4 per cent of the total geographical area includes some of the highest peaks in the world and makes India one of the richest areas in terms of habitats and species. The steep slopes, unconsolidated soils and intense rainfall render the zone extremely fragile. The alpine and sub-alpine forests, grassy meadows and moist mixed deciduous forests provide diverse habitat for endangered species of bovids such as Bharal (Pseudois nayaur), Ibex (Capra ibex), Markhor (Capra falconeri), Himalayan Tahr (Hemitragus Jemlahicus) and Takin (Budorcas taxicolor). Other rare and endangered species restricted to this zone include Hangul (Cervus canadensis hanglu) and Siberian Musk Deer (Moschus moschiferus).

Indian Desert Zone, constituting 6.6 per cent of the total geographical area, includes the Thar and the Kutch deserts and has large expanses of grassland that supports several endangered species of mammals such as Wolf (Canis lupus), Caracal (Felis caracal), Desert Cat (Felis libyca) and birds of conservation interest viz., Houbara Bustard (Chlamydotis undulata) and the Great Indian Bustard (Ardeotis nigriceps).

Semi-arid Region, constituting 16.6 per cent of the total geographical area, is a transition zone between the desert and the dense forests of Western Ghats. Peninsular India has two large regions, which are climatically semi-arid. This semi-arid region also has several artificial and natural lakes and marshy lands. The dominant grass and palatable shrub layer in this zone supports the highest wildlife biomass. The cervid species of Sambar (Cervus unicolor) and Chital (Axis axis) are restricted to the better wooded hills and moister valley areas respectively. The Asiatic Lion (Leo Persica), an endangered carnivore species (restricted to a small area in Gujarat), Caracal (Felis caracal), Golden Jackal (Canis aureus) and Wolf (Canis lupus) are some of the endangered species that are characteristic of this region.

Western Ghats, constituting 4.0 per cent of the total geographical area, is one of the major tropical evergreen forest regions in India. The zone stretches from the hills to the South of the Tapti River in the North to Kanyakumari in the South and in the West. This zone is bound by the coast. This zone represents one of the biodiversity 'hot spots' with some 15,000 species of higher plants, of which 4,000 (27 per cent) are endemic to the region. The Western Ghats harbour viable populations of most of the vertebrate species found in peninsular India, besides an endemic faunal element of its own. Significant species endemic to this region include Nilgiri Langur (Presbytis johni), Lion Tailed Macaque (Macaca silenus), Grizzled Giant Squirrel (Ratufa macroura), Malabar Civet (Viverra civettina), Nilgiri Tahr (Hemitragus hylocrius) and Malabar Grey Hornbill (Ocyceros griseus). The Travancore Tortoise (Indotestudo travancorica) and Cane turtle (Heosemys silvatica) are two endangered species restricted to a small area in central Western Ghats.

Deccan Plateau, constituting 42 per cent of the total geographical area, is a semi-arid region that falls in the rain shadow area of the Western Ghats. This bio-geographic zone of peninsular India is by far the most extensive zone, covering India's finest forests, particularly in the States of Madhya Pradesh, Maharashtra and Orissa. Majority of the forests are deciduous in nature but there are regions of greater biological diversity in the hill ranges. The zone comprising of deciduous forests, thorn forests and degraded scrubland support diverse wildlife species. Species such as Chital (Axis axis), Sambar (Cervus unicolor), Nilgai (Boselaphus tragocamelus) and Chousingha (Tetracerus quadricornis) are abundant in this zone. Some other species like Barking deer (Muntiacus muntjak), Gaur (Bos gaurus) and Black Buck (Antilope cervicapra) are more frequent in, or are restricted to

moister areas, but are still found in fairly large numbers. Species with small populations include the Elephant (Elephas maximus) in Bihar–Orissa and Karnataka-Tamil Nadu belts.

Gangetic Plain, constituting 10.8 per cent of the total geographical area, is a flat alluvial region lying to the North and South of the Ganga River and its major tributaries and in the foothills of the Himalayas. The Gangetic plain is topographically homogenous for hundreds of kilometres. The characteristic fauna of this region include Indian Rhino (Rhinoceros unicornis), Asian Elephant (Elephas maximus), Water Buffalo (Bubalus bubalis), Swamp Deer (Cervus duvaucelii), Indian Hog-Deer (Axis porcinus) and Hispid Hare (Caprolagus hispidus). This zone gains considerable ecological significance in the context of increasing industrialization and pollution and the consequent environmental degradation and deforestation.

North-East Region, constituting 5.2 per cent of the total geographical area, represents the transition zone between the Indian, Indo-Malayan and Indo-Chinese bio-geographical regions as well as being a meeting point of the Himalayan Mountains and peninsular India. The North-East is thus the bio-geographical 'gateway' for much of India's fauna and flora and also a biodiversity hotspot. A diverse set of habitats coupled with long term geological stability has allowed the development of significant levels of endemism in all animal and plant groups. Many of the species contributing to this biological diversity are either restricted to the region itself, or to the smaller localized areas of the Khasi Hills. The country's extensive Coasts, constituting 2.5 per cent of the total geographical area with sandy beaches, mangroves, mud Nepenthes Khasiana - commonly known as *Pitcher Plant*, coral reefs and marine angiosperm pastures make them the wealth and health zones of India. The coastline from Gujarat to Sundarbans is estimated to be 5,423 km long. A total of 25 islets constitute the Lakshadweep, which are of coral origin, and have a typical reef lagoon system, rich in biodiversity. However, the densely populated Lakshadweep islands virtually have no natural vegetation.

Andaman and Nicobar Islands, constituting 0.3 per cent of the total geographical area are one of the three tropical moist evergreen forests zones in India. The islands house an array of flora and fauna not found elsewhere. The elongated North-South oriented groups of 348 Andaman Islands have a bio-geographical affinity with Myanmar. The Nicobar Islands, lying only 90 kms away from Sumatra have much stronger Indonesian and South-East Asian elements. These islands are centres of high endemism and contain some of India's finest evergreen forests and support a wide diversity of corals. However, endemic island biodiversity is found only in the Andaman and Nicobar Islands. Wetlands occur in various geographical regions such as the cold arid zones of Ladakh, warm arid zones of Rajasthan, tropical monsoonal Central India, North Eastern region, south peninsular region and the coastal wetlands.

India is home to several well known large mammals including the Asian Elephant, Bengal Tiger, Asiatic Lion, and Leopard, Sloth Bear and Indian Rhinoceros, often engrained culturally and religiously often being associated with deities. Other well known large Indian mammals include ungulates such as the rare Wild Asian Water buffalo, common Domestic Asian Water buffalo, Nilgai, Gaur and several species of Deer and Antelope. Some members of the dog family such as the Indian Wolf, Bengal Fox, Golden Jackal and the Dhole or Wild Dogs are also widely distributed. However, the Dhole also known as the *whistling hunter* are the most endangered top Indian

carnivore, and Himalayan Wolf is now critically endangered endemic species to India. It is also home to the Striped Hyena, Macaques, Langur and Mongoose species.

The need for conservation of wildlife in India is often questioned because of the apparently incorrect priority in the face of direct poverty of the people. However Article 48 of the Constitution of India specifies that, "The state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country" and Article 51 (A) states that "it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures." Large and charismatic mammals are important for wildlife tourism in India and several national parks and wildlife sanctuaries cater to these needs. ***Project Tiger*** started in 1972 is a major effort to conserve the tiger and its habitats. At the turn of the 20th century, one estimate of the tiger population in India placed the figure at 40,000, yet an Indian tiger census conducted in 2008 revealed the existence of only 1411 tigers. Various pressures in the later part of the 20^{th} century led to the progressive decline of wilderness resulting in the disturbance of viable tiger habitats. At the International Union for the Conservation of Nature and Natural Resources (IUCN) General Assembly meeting in Delhi in 1969, serious concern was voiced about the threat to several species of wildlife and the shrinkage of wilderness in the India. In 1970, a national ban on tiger hunting was imposed and in 1972 the Wildlife Protection Act came into force. The framework was then set up to formulate a project for tiger conservation with an ecological approach. Launched on April 1, 1973, Project Tiger has become one of the most successful conservation ventures in modem history. The project aims at tiger conservation in specially constituted 'tiger reserves' which are representative of various bio-geographical regions falling within India. It strives to maintain a viable tiger population in their natural environment. Today, there are 39 Project Tiger wildlife reserves in India covering an area more than 37,761 km^2. Project Elephant, though less known, started in 1992 and works for elephant protection in India. Most of India's Rhinos today survive in the Kaziranga National Park. The exploitation of land and forest resources by humans along with hunting and trapping for food and sport has led to the extinction of many species in India in recent times. These species include mammals such as the Indian/Asiatic Cheetah, Javan Rhinoceros and Sumatran Rhinoceros. While some of these large mammal species are confirmed extinct, there have been many smaller animal and plant species whose status is harder to determine.

HOT SPOTS IN INDIA

India has two identified biodiversity hot spots. These are the Eastern Himalayas and the Western Ghats.

Eastern Himalaya

Phytogeographically, the Eastern Himalaya forms a distinct floral region and comprises of Nepal, Bhutan, states of East and North-East India, and a contiguous sector of Yunnan province in South-Western China. In the whole of Eastern Himalaya, there are an estimated 9,000 plant species, out of which 3,500 (i.e. 39 per cent) are endemic. In the Indian portion, there occurs some 5,800 plant species, roughly 2,000 (i.e. 36 per cent) of which are endemic. At least 55 flowering plants endemic to this area are recognised as rare, for example, the Pitcher Plant (Nepenthes khasiana). The area has long been recognised 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. Gymnosperm and Pteridophyta (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, Areca nut, Palmyra Palm, sugar palm and wild date palm. Tea (Camellia 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. As regards faunal diversity, 63 per cent of the genera of land mammals in India are found in this region. During the last four decades, two new mammals have been discovered from the region - Golden Langur from Assam-Bhutan region, and Namdapha Flying Squirrel from Arunachal Pradesh, indicating the species richness of the region. The region is also a rich centre of avian diversity - more than 60 per cent of the bird species found in India have been recorded in the North East. The region also hosts two endemic genera of lizards, and 35 endemic reptilian species, including two turtles. Of the 240 Indian amphibian species, at least 68 species are known to occur in the North East, 20 of which are endemic. From Namdapha National Park itself, a new genus of mammal, a new subspecies of a bird, six new amphibians' species, four new species of fish, at least 15 new species of beetles and six new species of flies have been discovered.

Western Ghats

The Western Ghats region is considered to be one of the most important bio-geographic zones of India, as it is one of the richest centres of endemism. Due to varied topography and microclimatic regimes, some areas within the region are considered to be active zones of speciation. The region has 490 arborescent taxa, of which as many as 308 are endemic. About 1,500 endemic species of dicotyledonous plants are reported from the Western Ghats. 245 species of orchids belonging to 75 genera are found here, of which 112 species in ten genera are endemic to the region. As regards the fauna, as many as 315 species of vertebrates belonging to 22 genera are endemic, including 12 species of mammals, 13 species of birds, 89 species of reptiles, 87 species of amphibians and 104 species of fish. The extent of endemism is high amongst amphibian and reptile species. There occur 117 species of amphibians in the region, of which 89 species (76 per cent) are endemic. Of the 165 species of reptiles found in Western Ghats, 88 species are endemic. Many of the endemic and other species are listed as threatened. Nearly 235 species of endemic flowering plants are considered endangered. Rare fauna of the region include - Lion Tailed Macaque, Nilgiri Langur, Nilgiri Tahr, Flying Squirrel, and Malabar Gray Hornbill.

Wetlands in India are distributed in different geographical regions, ranging from the Himalaya to the Deccan plateau. The variability in climatic conditions and topography is responsible for significant diversity. Based on their origin, vegetation, nutrient status and thermal characteristics, they are classified into following different types:

- Glaciatic Wetlands (e.g., Tsomoriri in Jammu and Kashmir, Chandra Tal in Himachal Pradesh)
- Tectonic Wetlands (e.g., Nilnag in Jammu and Kashmir, Khajjiar in Himachal Pradesh, and Nainital and Bhimtal in Uttaranchal)
- Oxbow Wetlands (e.g., Dal Lake, Wular Lake in Jammu and Kashmir and Loktak Lake in Manipur and some of the wetlands in the river plains of Brahmaputra and Indo - Gangetic region, Dipor Bil in Assam, Kabar in Bihar, Surahtal in Uttar Pradesh)
- Lagoons (e.g., Chilika in Orissa)
- Crater Wetlands (Lonar lake in Maharashtra)
- Salt Water Wetlands (e.g., Pangong Tso in Jammu and Kashmir and Sambhar in Rajasthan)

- Urban Wetlands (e.g., Dal Lake in Jammu and Kashmir, Nainital in Uttaranchal and Bhoj in Madhya Pradesh)
- Ponds/Tanks, Man-made Wetlands (e.g. Harike in Punjab and Pong Dam in Himachal Pradesh)
- Reservoirs (e.g., Idukki, Hirakud dam, Bhakra-Nangal dam)
- Mangroves (e.g., Bhitarkanika in Orissa)
- (Coral reefs (e.g., Lakshadweep)
- Others - Creeks (Thane Creek in Maharashtra), sea grasses, estuaries, and thermal springs are some other types of wetlands in the country.

Biodiversity and Protected Areas

India has some 2,356 known species of amphibians, birds, mammals and reptiles according to figures from the World Conservation Monitoring Centre, of these, 18.4 per cent are endemic, meaning they exist in no other country and 10.8 per cent are threatened. India is home to at least 18,664 species of vascular plants, of which 26.8 per cent are endemic. About 4.9 per cent of the country's area is protected-under IUCN categories I-V.

1. Nature Reserves, Wilderness Areas, and National Parks (categories I and II)
2. Areas Managed for Sustainable Use and Unclassified Areas (category VI and 'other')
3. Natural Monuments, Species Management Areas and Protected Landscapes and Seascapes (categories III, IV, and V)

Biosphere Reserves

The programme of Biosphere Reserve was initiated under the 'Man & Biosphere' (MAB) programme of UNESCO in 1971. The purpose of the formation of the biosphere reserve is to conserve in-situ all forms of life, along with its support systems, in their totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems. The first biosphere reserve of the world was established in 1979. Since then the network of biosphere reserves has increased to 531 in 105 countries across the world (MAB, 2008).

The Indian government has established fifteen Biosphere Reserves of India which protect larger areas of natural habitat and often include one or more National Parks and/or preserves, along buffer zones that are open to some economic uses. Protection is granted not only to the flora and fauna of the protected region, but also to the human communities who inhabit these regions, and their ways of life.

The Bio-reserves in India

1. Achanakmar-Amarkantak	7. Kutch	13. Pachmarhi
2. Agasthyamalai	8. Kanchenjunga	14. Simlipal
3. Dibru Saikhowa	9. Manas	15. Sundarbans
4. Dihang-Dibang	10. Nanda Devi	
5. Great Nicobar	11. The Nilgiris	
6. Gulf of Mannar	12. Nokrek	

Seven of the fifteen biosphere reserves are a part of the World Network of Biosphere Reserves, based on the UNESCO Man and the Biosphere Programme (MAB) list.

1) Gulf of Mannar Biosphere Reserve
2) Nanda Devi Biosphere Reserve
3) Nilgiri Biosphere Reserve
4) Nokrek National Park
5) Pachmarhi Biosphere Reserve
6) Simlipal National Park
7) Sundarbans Biosphere Reserve