

BIODIVERSITY



Chapter 7

Biodiversity

Biodiversity starts in the distant past and it points towards the future

-Frans Lanting

Introduction

7.1 Biodiversity means the 'diversity' of life on Earth at all levels, from genes to ecosystems. It includes diversity within species, between species and of ecosystems. Biodiversity includes all ecosystems- manmade (plantations, farms, croplands, aquaculture sites, urban parks) and natural (forests, nature preserves or national parks) and represents the wealth of biological resources available to human beings. The diversity of life on earth is essential for the healthy functioning of ecosystems and it is biodiversity that boosts ecosystem productivity. It is high time the mankind realizes the fact that economies are embedded in nature and are not external to it.

7.2 Today there are 8-20 million species¹ of organisms, may be more, with cells containing a distinct nucleus that houses genetic material in the form of chromosomes (such organisms are called eukaryotes). Only about 2 million eukaryotes have been recognized and named so far. There are in addition unknown and much larger numbers of archaea and bacteria, which do not have a cell nucleus (they are called prokaryotes). But biodiversity does not only pinpoint the number of species of organisms that inhabit the Earth, it has further deeper dimensions, including the genes these organisms contain and, the functional characteristics of the ecosystems in which they live. The chemical reactions of Earth's plants, algae and many bacteria sustain life by converting sunlight and nutrients into food, useable energy, and the building blocks of life, as well as recycling waste. Their activities are often both silent and hidden from view, but they enable ecosystems to function and provide a multitude of services on which we rely. The biosphere, which is the part of Earth occupied by living organisms, is a regenerative entity. Since the ability to regenerate is a characteristic of living systems, regeneration of the biosphere is key to the sustainability of the human enterprise. Ecosystems are actually constituents of the biosphere.

¹

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957292/Dasgupta_Review_-_Abridged_Version.pdf

Linkages of Biodiversity to Economy

7.3 Nature's goods and services are the foundations of our economies. They include the provisioning services that supply the goods we harvest and extract (food, water, fibres, timber, medicines) and cultural services, such as the gardens, parks and coastlines we visit for pleasure, even emotional sustenance and recuperation. But, in addition to these Nature's processes also maintain a genetic library, preserve and regenerate soil, control floods, filter pollutants, assimilate waste, pollinate crops, maintain the hydrological cycle, regulate climate and fulfil many other functions. Without these regulating and maintenance services, life would not be possible.

7.4 Depreciation is the decline in the quantity or quality of an asset over time. In the case of ecosystems, depreciation is the difference between the rate at which it is harvested and its regenerative rate. If human extraction of an ecosystem's provisioning services exceeds its regenerative rate, the ecosystem depreciates.

Figure 7.1: Links from Biodiversity to the Economy



Source: The Economics of Biodiversity: the Dasgupta Review (Abridged Version)

India- A Mega Diverse Region

7.5 Biodiversity is a characteristic of ecosystems. It enables ecosystems to flourish and supply the wide variety of services on which mankind is dependent upon. The various factors that influence the biodiversity of a region include temperature, altitude, precipitation, soils and pressures from the human activities. The biodiversity profile of a country at any point of time reflects the presence of different variety of taxa of flora and

fauna, the consequences of the way it has been utilized and how it has been conserved through legal or other measures. For instance, the faunal species of India has steadily climbed up making India the world's 8th highest mega biodiverse country². Different aspects of India's biodiversity have been discussed in the 2020 issue of this publication³.

7.6 India has tremendously rich in species and ecosystem diversity. Over 1,03,258 species of fauna and 55,048 species of flora have been documented in the 10 biogeographic zones of the country. Considering floral diversity, out of the 55,048 known plant species in India, 12,095 are endemic (Table 7.1). Endemism describes taxa that are distributed on particular areas. Endemic species are those that live in a limited area, such as a mountain range, lake or island, among others.

Table 7.1: India's Floral Species Diversity and Endemism – 2021

Major Groups	Number of Species	No. of Endemic Species	No. of Threatened Species
Flowering Plants			
Gymnosperms	82	12	12
Angiosperms	21,984	4,556	416
Non-flowering Plants			
Bryophytes	2,800	640	7
Pteridophytes	1,314	74	2
Others			
Virus & Bacteria	1,269	26	
Algae	9,008	1,965	
Fungi	15,602	c. 4240	1
Lichens	2,989	c. 582	
Total	55,048	12,095	

Source: Botanical Survey of India, Kolkata.

7.7 In the case of fauna, 28,948 species are endemic to the country and account for 28% of the total 1,03,258 species identified so far in India. **Table 7.2** shows the known faunal species, their endemism and threat status.

² Animal Discoveries 2020, Zoological Survey of India

³ EnviStats India 2020, Vol. II

Table 7.2: India's Faunal Species Diversity and Endemism – 2021

Major Groups	Number of Species	No. of Endemic Species	No. of Threatened Species
Protozoans	3,557	645	
Invertebrates	92,741	27,125	135
Chordates, Cephalochordates and Urochordates	6,960	1,178	540
<i>Of which</i>			
Fishes	3,496	500	228
Amphibia	443	296	75
Reptilia	706	255	54
Birds	1,346	81	89
Mammals	432	46	94
Total	1,03,258	28,948	675

Source: Zoological Survey of India, Kolkata, 2022.

7.8 Along with many other countries, India has its own fair share of issues due to Invasive Alien Species. Alien species ⁴ is a species, subspecies or lower taxon, introduced outside its natural past or present distribution, which includes any part, gametes, seeds, eggs or propagules of such species that might survive and subsequently reproduce. Invasive alien species are species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity⁵. Some examples of the commonly found faunal alien species in India are the African apple snail (*Achatina fulica*), Papaya Mealy Bug (*Paracoccus marginatus*), Cotton Mealy Bug (*Phenacoccus solenopsis*) and Amazon sailfin catfish (*Pterygoplichthys pardalis*), while commonly found floral alien species in India are Prosopis Juliflora, Vilayti Kikar, Parthenium Hysterophorus, Lantana Camara and Water Hyacinth (*Eichhornia crassipes*).

7.9 In recent past, Invasive Alien Species have been emerging as the second biggest threat to global biodiversity after habitat fragmentation. Invasive Alien Species Management, preventing the entry and periodical monitoring of the alien species in a new habitat, is one of the important steps to be followed to get rid of the Invasive Alien Species menace.

⁴ Invasive Alien Species: Threat to inland wetlands of India, Centre for Biodiversity Policy and Law (CEBPOL)

⁵ [https://www.cbd.int/invasive/WhatareIAS.shtml#:~:text=Invasive%20alien%20species%20\(IAS\)%20are,affect%20all%20types%20of%20ecosystems.](https://www.cbd.int/invasive/WhatareIAS.shtml#:~:text=Invasive%20alien%20species%20(IAS)%20are,affect%20all%20types%20of%20ecosystems.)

Table 7.3: Invasive Alien Species of India

Category	Number of Invasive Alien Species
Terrestrial Plants	54
Aquatic Ecosystem	56
Agriculture Ecosystem	47
Island Ecosystem	14
Total	171

Source: National Biodiversity Authority

Taxonomic diversity of India

7.10 The Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI) (largest faunal specimen repositories in the world⁶) are the two apex organisations of India that have been actively engaged in taxonomic study of all major groups of Indian plants and animals, respectively. Every year, these two organisations collate information on the discoveries during the previous year using the research published by scientists on various aspects of taxonomy including species new to science and new records. **Table 7.4** below gives the phylum-wise details of the taxonomic diversity of India compiled using information from the BSI and ZSI.

Table 7.4: Number of Fauna and Flora Species in India – 2021

Category	Taxonomic group	Number of Species in India
FAUNA INVERTEBRATA	Protista	3,557
	Phylum Protozoa	3,557
	Animalia	99,701
	Phylum Mesozoa	10
	Phylum Porifera	571
	Phylum Cnidaria	1,461
	Phylum Ctenophora	20
	Phylum Platyhelminthes	1,800
	Phylum Rotifera	467
	Phylum Gastrotrichida	163
	Phylum Kinorhyncha	10
	Phylum Nematoda	3,017
	Phylum Acanthocephala	308
	Phylum Sipuncula	41
	Phylum Mollusca	5,249
	Phylum Echiura	47
	Phylum Annelida	1,051
	Phylum Onychophora	1

⁶ <https://zsi.gov.in/WriteReadData/userfiles/file/Annual%20Report/Annual%20Report%202020-21.pdf>

Category	Taxonomic group	Number of Species in India
FLORA	Phylum Arthropoda	77,270
	Phylum Phoronida	3
	Phylum Bryozoa (Ectoprocta)	350
	Phylum Entoprocta	10
	Phylum Brachiopoda	8
	Phylum Chaetognatha	44
	Phylum Tardigrada	32
	Phylum Nemertea	6
	Phylum Echinodermata	788
	Phylum Hemichordata	14
	Phylum Protochordata	
	Phylum Chordata	6,960
	<i>Of Which</i>	
VERTEBRATA	Class Pisces: Fresh water Fishes	3,496
	Class Pisces: Marine and Estuarine Fishes	
	Class Amphibia	443
	Class Reptilia	706
	Class Aves	1,346
	Class Mammalia	432
TOTAL FAUNAL SPECIES		1,03,258
FLORA	Virus/Bacteria	1,269
	Algae	9,008
	Fungi	15,602
	Lichens	2,989
	Bryophytes	2,800
	Pteridophytes	1,314
	Gymnosperms	82
	Angiosperms	21,984
TOTAL FLORAL SPECIES		55,048
GRAND TOTAL (FLORA + FAUNA)		1,58,306

Source: Botanical Survey of India, Zoological Survey of India

Agro-Biodiversity Hot spots of India

7.11 Hotspots are earth's biologically richest places with vast number of species found nowhere else. India is one among the megadiverse country⁷. Biodiversity hot spots are areas that are rich in species, most of which are endemic and are under constant threat of being overexploited. Agrobiodiversity is a vital sub-set of biodiversity and is more related to genetic diversity. FAO defines it as the variety and variability of animals, plants

⁷ Megadiversity: Earth's Biologically Wealthiest Nations, Russell A. Mittermeier, 2004

and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fibre, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems⁸.

7.12 India is a center of origin or diversity for several crops such as rice, sugarcane, coconut, arecanut, maize, mango, coffee etc. The long farming tradition, soil features topography and rainfall variation have permitted the development of diverse agricultural ecosystems and enormous biodiversity in the region. The list of Agrobiodiversity hot spots in India as identified by the Protection of Plant Varieties and Farmers' Right Authority is provided in the **Annexure 7.1**.

Status of Leopard in India

7.13 Large animals need large areas. When these areas are protected, thousands of other plants and animals also benefit from this protection. Failing to protect them can lead not only to the extinction of these species, but the loss of many other plant and animal species that make up the ecological community of their habitat. This loss of species and genetic level biodiversity also impacts ecosystem functions and makes ecosystems less resilient to environmental shocks and change (including climate change). This also threatens the supply of future ecosystem services. These considerations are reflected in India's long-standing and successful track record of protecting its tigers and elephants.

7.14 Leopards serve as apex predators in most of the forested landscapes in India, beyond the realm of tiger and lion. Leopard is vitally important in culling its prey-base in a sustainable manner. In the absence of these, the prey-base would breed exponentially with no natural control and the forest would not be capable to provide sufficient fodder to the prey base.

7.15 Leopard (*Panthera pardus*) is the most widely distributed and adaptable member of the family Felidae. The Indian subspecies, *Panthera pardus fusca*, is found in all forested habitats in the country, absent only in the arid deserts and above the timber line in the Himalayas⁹. The current distribution and numbers of Leopard have significantly decreased across the range due to habitat loss, prey depletion, conflict and poaching over the last century. In IUCN, its status changed from 'Near Threatened' to 'Vulnerable'¹⁰. It is also listed in Appendix I of the Convention on International Trade of Endangered Species

⁸ FAO, 1999a <https://www.fao.org/3/y5609e/y5609e01.htm>

⁹ Status of Leopards in India, 2018

¹⁰ <https://www.iucn.org/news/species/201610/keeping-leopards-spotlight-cites>

of Wild Fauna and Flora (CITES) and in Schedule I of the Wildlife (Protection) Act 1972 in India providing it with the highest level of protection.

7.16 In India, the population estimates of Leopard are obtained along with the assessment for the tigers, which acts as an umbrella species for majority of eco-regions in the Indian subcontinent. The National Tiger Conservation Authority (NTCA) in collaboration with the State Forest Departments, Conservation NGO's and coordinated by the Wildlife Institute of India (WII), conducts a National assessment for the "Status of Tigers, Co-predators, Prey and their Habitat" every four years since 2006. This exercise not only comes up with tiger numbers for the country but also evaluates the status of co-predators, prey, habitat and human disturbance parameters. Third cycle of this assessment yielded the first country-wide minimal population estimation of leopards at 7,910 (SE 6,566-9,181) in forested habitats of 18 tiger-bearing states of the country¹¹.

7.17 The fourth cycle of the tiger assessment, undertaken in 2018, also estimated leopard abundance for each tiger conservation landscape in India. The fourth status assessment was the most comprehensive to date, in terms of both resource and data amassed. The likelihood based Spatially Explicit Capture Recapture (SECR) method was used to estimate leopard abundance from camera trap data. The 2018 estimates of leopard population in India is 12,852 with standard error limit 12,172-13,535. The status of Leopard population estimates in the forested areas of tiger states in 2018 is given in Table.

Table 7.5: Leopard population estimates in the forested areas of tiger states, 2018

State	Population estimates with SE limits
Shivalik Hills & Gangetic Plains	
Bihar	98 (90-106)
Uttarakhand	839 (791-887)
Uttar Pradesh	316 (277-355)
Shivalik-Gangetic	1,253 (1,158-1,348)
Central India & Eastern Ghats	
Andhra Pradesh	492 (461-523)
Telangana	334 (318-350)
Chhattisgarh	852 (813-891)
Jharkhand	46 (36-56)
Madhya Pradesh	3,421 (3,271-3,571)
Maharashtra	1,690 (1,591-1,789)
Odisha	760 (727-793)
Rajasthan	476 (437-515)
Central India & Eastern Ghats	8,071 (7,654-8,488)
Western Ghats	
Goa	86 (83-89)
Karnataka	1,783 (1,712-1,854)
Kerala	650 (622-678)
Tamil Nadu	868 (828-908)
Western Ghats	3,387 (3,245-3,529)

¹¹ Status of Leopards in India, 2018

State	Population estimates with SE limits
North East Hills, and Brahmaputra Flood Plains*	
Arunachal Pradesh (Pakke)	11 (8-14)
Assam (Manas, Nameri and Kaziranga)	47 (38-56)
West Bengal (Gorumara, Jaldapara and Buxa)	83 (66-100)
North East Hills, and Brahmaputra Flood Plains*	141 (115-170)
TOTAL	12,852 (12,172-13,535)

Source: *Status of Leopards in India, 2018*

* Estimates are only from camera trap sites

Conservation Measures in India

7.18 Biological resources nationally and globally are depleting at an alarming rate in the last few decades due to increased destructive anthropogenic factors causing distress to all biological forms and disrupting the ecosystems. There are two broad approaches in conservation that are adopted to protect and maintain biodiversity – in-situ and ex-situ. In-situ conservation refers to the conservation of species in their natural habitats, while ex-situ conservation is the preservation of components of biological diversity outside their natural habitats, e.g., zoos. In-situ conservation is considered the most appropriate way of conserving biodiversity. Conserving the areas where populations of species exist naturally is an underlying condition for the conservation of biodiversity and hence, protected areas form a central element of any national strategy to conserve biodiversity.

7.19 In India, the Protected Areas are declared under Wildlife (Protection) Act, 1972. India has 18 biosphere reserves and 99 conservation reserves. Amongst the protected areas, India has 106 national parks and 564 sanctuaries covering an area of 1.7 lakh sq. km. EnviStats- India: Vol. II 2020 provides the detailed discussion on these protected areas. Table 7.6 provides the status of different categories of Protected Areas in India and Table 7.8 provides the status of Protected Areas of India since 2000.

Table 7.6: Status of different categories of Protected Areas in India

Categories of Protected Area	Number	Area (in Km ²)
Protected Area	National Parks	106
	Wild Life Sanctuaries	564
	Community Reserves	218
	Conservation Reserves	99
	Total	987
Of Which Marine Protected Areas	National Parks	10
	Sanctuaries	115
	Community/ Conservation Reserves	4
	Total	129
		8717

Source: 1. Wildlife Institute of India and K Sivakumar, Coastal and Marine Biodiversity Protected Areas in India: Challenges and Way Forward, K. Venkataraman et al. (eds.), Ecology and Conservation of Tropical Marine Faunal Communities, Springer-Verlag Berlin Heidelberg 2013.

State-wise number of Terrestrial and Marine Protected Areas is given at Statement 1.29 and Statement 1.32 of EnviStats-India Vol I : Environment Statistics -2022¹²

Table 7.7: Protected Areas of India from 2000 to 2021 (As on December, 2021)

Year	National Parks		Wild Life Sanctuaries		Community Reserves		Conservation Reserves		Total Protected Area	
	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)	Number	Area (km ²)
2000	89	37,803.1	485	1,08,862.5	-	-	-	-	574	1,46,665.6
2006	96	38,392.1	503	1,11,229.5	1	0.3	4	42.9	604	1,49,664.8
2007	98	38,428.9	507	1,11,529.0	5	21.0	7	94.8	617	1,50,073.7
2008	99	39,441.7	510	1,13,123.4	5	21.0	45	1,259.8	659	1,53,845.9
2009	99	39,441.7	512	1,13,395.4	5	21.0	45	1,259.8	661	1,54,117.9
2010	102	40,283.6	516	1,13,842.9	5	21.0	47	1,382.3	670	1,55,529.8
2011	102	40,283.6	518	1,13,998.8	5	21.0	52	1,801.3	677	1,56,104.7
2012	103	40,500.1	526	1,14,933.4	5	21.0	59	2,012.9	693	1,57,467.5
2013	102	40,500.1	532	1,17,123.6	19	30.9	64	2,232.6	717	1,59,887.3
2014	103	40,500.1	535	1,18,290.7	43	58.2	64	2,232.6	745	1,61,081.6
2015	103	40,500.1	541	1,18,866.4	44	59.5	71	2,548.8	759	1,61,974.9
2016	103	40,500.1	543	1,18,917.7	45	59.7	72	2,566.2	763	1,62,043.7
2017	103	40,500.1	544	1,18,931.8	46	72.6	76	2,588.0	769	1,62,092.5
2018	104	40,501.1	544	1,18,931.8	46	72.6	77	2,594.0	771	1,62,099.5
2019	101	40,564.0	553	1,19,757.0	163	833.3	86	3,858.3	903	1,65,012.6
2020	104	43,716.0	566	1,22,420.0	214	1,302.0	97	4,483.0	981	1,71,921.0
2021	106	44,372.4	564	1,22,509.3	218	1,445.7	99	4,726.2	987	1,73,053.7

Source: National Wildlife Database, Wildlife Institute of India

Note: 1. These data are based on availability of data from Forest Department and Gazette Notification notified by the Ministries.

1. Community Reserves and Conservation Reserves have been established in India from 2006 onwards. Hence these values are zero for the year 2000.

Red List Species in India

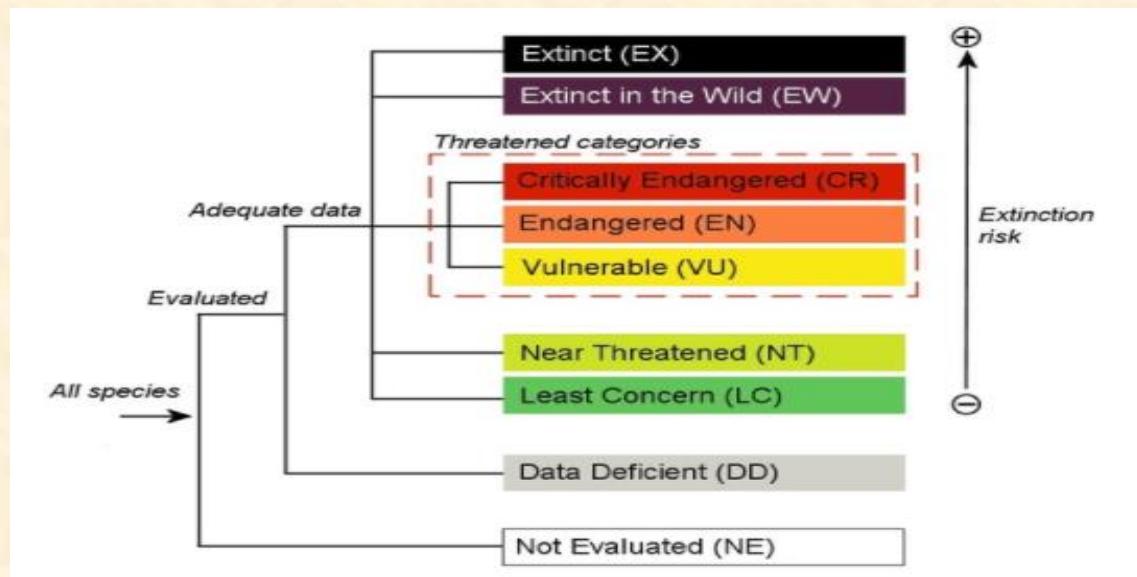
7.20 A well-managed ecosystem and the diversity of life they encompass are critical for a healthy, safe and prosperous world. The dynamic economic growth in countries is driving dramatic loss of biodiversity which is impacting the health of the societies and economies, thus increasing the vulnerability to the impacts of climate change and disasters. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is one of the most well-known objective assessment systems for classifying the status of plants, animals and other organisms threatened with extinction. It is a comprehensive information source on the global extinction risk status of animal, fungus and plant species¹³. It contains explicit criteria and categories to classify the conservation status of individual species on the basis of their probability of extinction.

¹² <https://www.mospi.gov.in/web/mospi/reports-publications/-/reports/view/templateFive/27706?q=RPCAT>

¹³ IUCN Red List of Threatened Species <https://www.iucnredlist.org/about/background-history>

7.21 The IUCN Red List categories and criteria are intended to be an easily and widely understood system for classifying species according to the risk of global extinction. It divides species into nine categories: Not Evaluated, Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct. These nine categories are shown below:

Figure: 7.2 IUCN Red List Categories



Source: IUCN Red List of Threatened Species™

7.22 Any species that has been assessed as Critically Endangered, Endangered or Vulnerable are called 'threatened species'. The IUCN list also includes 'Least Concern' Species, which have a lower risk of extinction, but are still important in terms of global biodiversity. Some 'Least Concern' species are undergoing slow declines and hence, it is important to monitor these species and to develop appropriate conservation actions to prevent them from becoming threatened in the future. The inclusion of the different categories of species helps track the changing status of biodiversity.

7.23 The IUCN Red List is a powerful tool to inform and catalyse action for biodiversity conservation and policy change, critical to protecting the natural resources required for survival. By providing information about range, population size, habitat and ecology, use and/or trade, threats and conservation actions, the IUCN Red List helps inform necessary conservation decisions and guide funding priorities.

7.24 The IUCN Red List relies on Assessors (trained individuals and species experts) to assess species based on the currently available data and information. The information is gathered from a range of sources, including published scientific papers, books, reports, expert knowledge, indigenous knowledge and citizen science. The Red List Authorities review the assessments, and then the IUCN Red List Unit checks the assessments before publishing them on IUCN Red List website.

IUCN Red List Spatial Data

7.25 The IUCN Red List of Threatened Species contains global assessments for over 147,500 species. The IUCN provides, in public domain, intercontinental species shape files with the Geographic Coordinate System as GCS_WGS_1984 and the Unit as Degree ($\sim 100\text{km}$). The IUCN data repository has spatial datasets on mammals, amphibians, birds, reptiles, fishes, plants and other groups. More than 81% of the total red list species (>120,500 species) have spatial data¹⁴. The data is freely accessible and includes taxonomic information, distribution status, IUCN Red List Category, sources and other relevant details. More information and resources can be found at the IUCN Red List Resources & Publications page¹⁵.

7.26 The IUCN spatial datasets can be used to evaluate the species richness of the red list species for any defined region/area. Species Richness represents a measure of the variety of species based simply on a count of the number of species in a particular sample and is generally expressed as the number of species per unit area.

7.27 In order to facilitate its use, the IUCN Red List Toolbox for ArcMap¹⁶ is also available alongside the dataset, which intersects the red list species polygon with a grid or shapefile of polygons, giving the number of species per cell or region polygon. The toolbox also enables the preparation of Species Richness Map, which shows the number of IUCN red list species found per pixel having an area of 0.07 degree², or roughly 865 sq.km.

7.28 To understand the distribution of the red-listed species in India, IUCN spatial datasets using the IUCN Red List of Threatened Species, Red List Version 2020-2 downloaded on August 31, 2020 were analyzed for Mammals, Amphibians and Reptiles. The results were published in EnviStats India Vol. II-2020. The analysis was extended to three more categories – Plants, Mangroves and Freshwater group (consisting of both flora and fauna present in freshwater) using IUCN Red List spatial datasets Version 2020-3 downloaded in December, 2020 and Version 2021-1 downloaded in May 2021 in EnviStats India Vol. II-2021. In the current publication, species richness counts have been calculated using data of 2021 Version 2, 2021 Version 3 and 2022 Version 1, downloaded in October, 2021, March, 2022 and August, 2022 respectively. The number of red listed species in India under these categories, as available in the IUCN spatial datasets is given in the following Table 7.8.

¹⁴ <https://www.iucnredlist.org/resources/spatial-data-download>

¹⁵ <https://www.iucnredlist.org/resources>

¹⁶ <https://www.iucnredlist.org/resources/spatialtoolsanddata>

Table 7.8: Data availability for India in IUCN Spatial Database

Species	Version	Critically Endangered		Near Threatened	Vulnerable	Least Concerned	Data Deficient	Grand Total
		CR	EN					
Mammals	2021-2	9	64	60	88	339	35	595
	2021-3	9	64	60	82	334	35	584
	2022-1	9	67	60	80	337	35	588
Amphibians	2021-2	20	36	13	23	119	87	298
	2021-3	20	36	14	25	118	88	301
	2022-1	20	36	14	25	119	90	304
Reptiles	2021-2	18	25	20	25	201	70	359
	2021-3	28	50	38	36	388	115	655
	2022-1	28	50	38	36	395	117	664
Mangroves	2021-2	1	1	4		32	2	40
	2021-3	1	1	4		32	2	40
	2022-1	1	1	4		32	2	40
Plants	Magnolias	2021-2	1	2		1	1	3
		2021-3	1	2		1	1	3
		2022-1	1	2		1	1	3
	Orchids#		74	108	50	505	18	15
				5		3	1	9
	Balsams#							
	Musa#		1				3	4
Fresh Water Group	Crabs	2021-2			3	4	25	66
		2021-3			3	4	25	66
		2022-1			3	4	25	66
	Crayfishes	2021-2					3	3
		2021-3					3	3
		2022-1					3	3
	Fishes (not comprehensive)	2021-2	20	97	56	129	749	195
		2021-3	20	97	56	129	749	195
		2022-1	18	97	57	134	763	199
	Molluscs (not comprehensive)	2021-2		5	2	6	505	155
		2021-3		5	2	6	505	155
		2022-1		5	2	6	505	155
	Odonata (not comprehensive)	2021-2		3	14	12	404	118
		2021-3		3	14	13	410	136
		2022-1		3	14	13	410	136
	Plants (not comprehensive)	2021-2	26	37	18	17	640	29
		2021-3	26	37	18	17	640	29
								767

Marine Group	Species	Version	Critically Endangered		Endangered	Near Threatened	Vulnerable	Least Concerned	Data Deficient	Grand Total
			CR	EN						
Shrimps	Shrimps	2022-1	26	37	18	17	640	29	767	
		2021-2		2		1	73	32	108	
		2021-3		2		1	73	32	108	
		2022-1		2		1	73	32	108	
	Scleractinian corals*	2021-2		10	117	131	195	20	473	
		2021-3		10	117	131	195	20	473	
		2022-1		10	117	131	195	20	473	
	Organ Pipe coral*	2021-2				1			1	
		2021-3				1			1	
		2022-1				1			1	
	Hydrozoa*	2021-2					5		5	
		2021-3					5		5	
		2022-1					5		5	
	Merostomata*	2021-2						2	2	
		2021-3						2	2	
		2022-1						2	2	
	Echinodermata*	2021-2		2	4		12	21	39	
		2021-3		2	4		12	21	39	
		2022-1		2	4		12	21	39	
	Cephalopoda*	2021-2					22	25	47	
		2021-3					22	25	47	
		2022-1					22	25	47	
	Bivalvia*	2021-2			1		2	1	4	
		2021-3			1		2	1	4	
		2022-1			1		2	1	4	
	Actinopterygii (Fishes)*	2021-2			15	9	395	89	508	
		2021-3			15	9	395	89	508	
		2022-1			15	9	395	89	508	
	Chondrichthyes (Fishes)*	2021-2	18	28	34	24	14	13	131	
		2021-3	18	28	34	24	14	13	131	
		2022-1	18	28	34	24	14	13	131	
	Reptiles*	2021-2	1	1	4		21	4	31	
		2021-3	1	1	4		21	4	31	
		2022-1	1	1	4		21	4	31	
	Mammals*	2021-2	1	3	3	2	13	11	33	
		2021-3	1	3	3	2	13	11	33	
		2022-1	1	3	3	2	13	11	33	

Source: Botanical Survey of India. Excluded from Spatial Distribution of Species.

*Source: Zoological Survey of India. Excluded from Spatial Distribution of Species.

7.29 From the **Table 7.8**, most of the Red List species in India are under the 'Least Concern' category. State-level red list species counts, as compiled using the IUCN Red List Toolbox, are given in the **Annexure 7.2**. The counts have been calculated using different versions of IUCN Red List data. The increase (decrease) in the species richness count does not necessarily show the true change in number of species for a state/region. Change can also be attributed to the increase in the number of species assessed and improvement in the knowledge of species' distribution. The richness count calculated also depends on the extent or boundaries of the shapefile used to calculate these values.

7.30 **Figure 7.3** shows the species richness of different species across the country. The species richness for different categories namely Amphibians, Reptiles, Mammals, Mangroves and Fresh Water Group has been mapped separately. The map denoting the richness of 'All Species', with the protected areas of India marked on the map includes only those species described in the **Annexure 7.1**.

Conclusion

7.31 India is a signatory to several major international conventions relating to the conservation and management of wildlife such as the Convention on Biological Diversity (CBD)¹⁷, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)¹⁸. There is a growing consciousness about the value of biodiversity and the need for its conservation.

7.32 The Government of India has taken several steps to protect the biodiversity. India brought out the National Environment Policy (NEP) in 2006 which provided the much-needed synergy and coherence for sustainable development in all the sectoral policies. The specific provisions of sector-specific polices help in protecting the biodiversity and conservation and sustainable use of natural resources. India reported its progress in implementing National Biodiversity Action Plan to CBD in 2019.

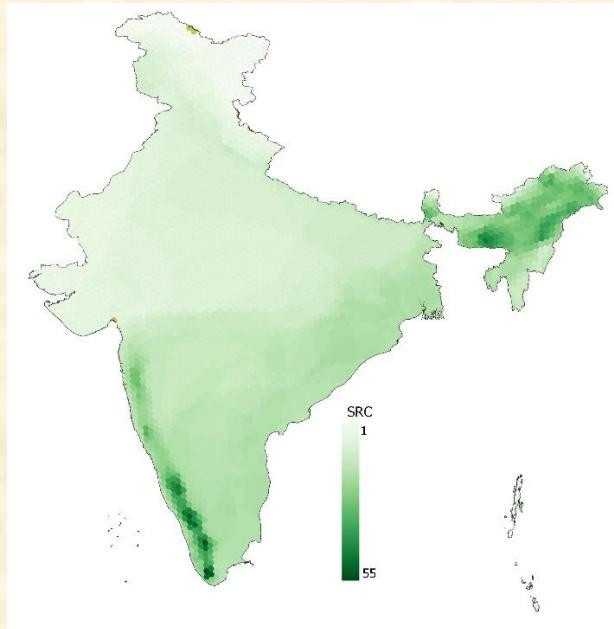
7.33 CBD will adopt a post-2020 global biodiversity framework as a stepping stone towards the 2050 Vision of "Living in harmony with nature" in its 15th meeting of Conference of Parties. The framework sets out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity and to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled.

7.34 The very existence of legislation and policies is a proof that some consensus has developed concerning the importance of conserving species and ecosystems. The current publication provides information about the biodiversity and enables to get a fair idea about the biodiversity scenario of the country. Biodiversity impacts many aspects of sustainability and keeping a tap on biodiversity which is vital for both environmental, social and economic development.

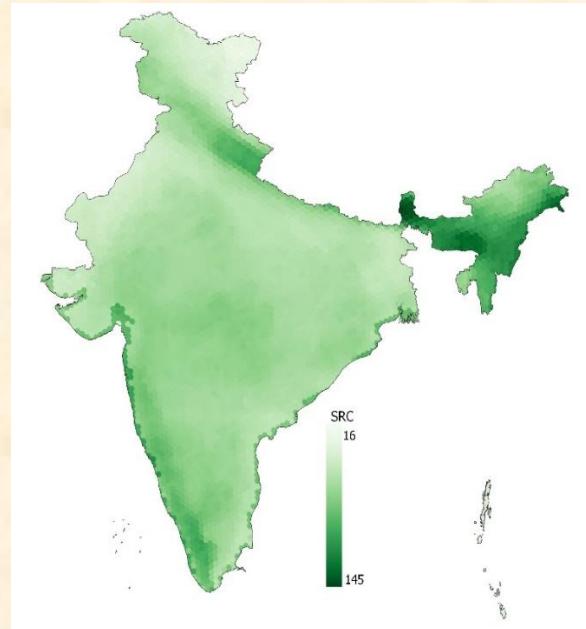
¹⁷ <https://www.cbd.int/countries/?country=in>

¹⁸ <https://cites.org/eng/parties/country-profiles/in>

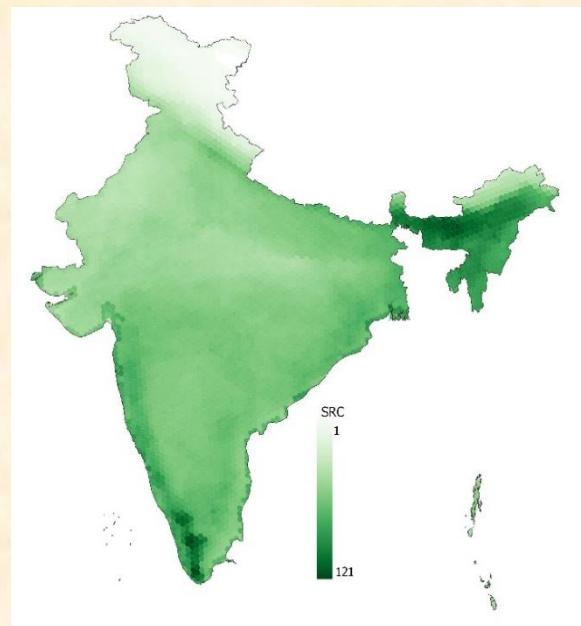
Figure 7.3: Species Richness of IUCN Red List Species



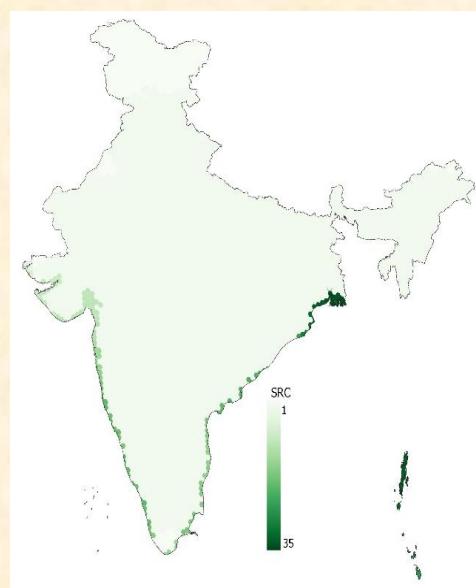
(a) Amphibians



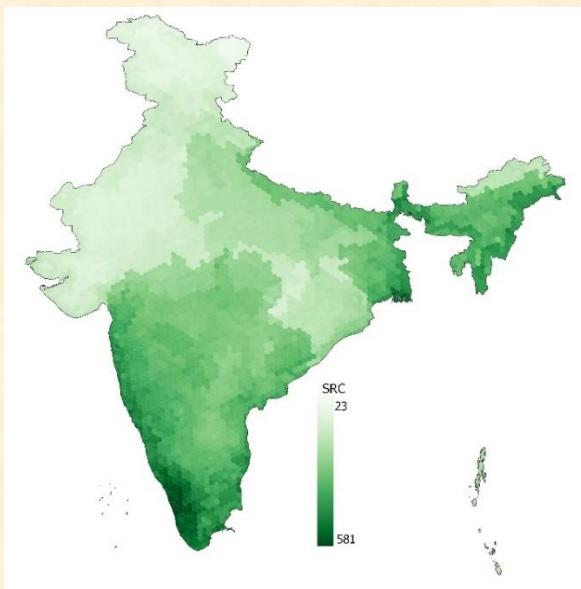
(b) Mammals



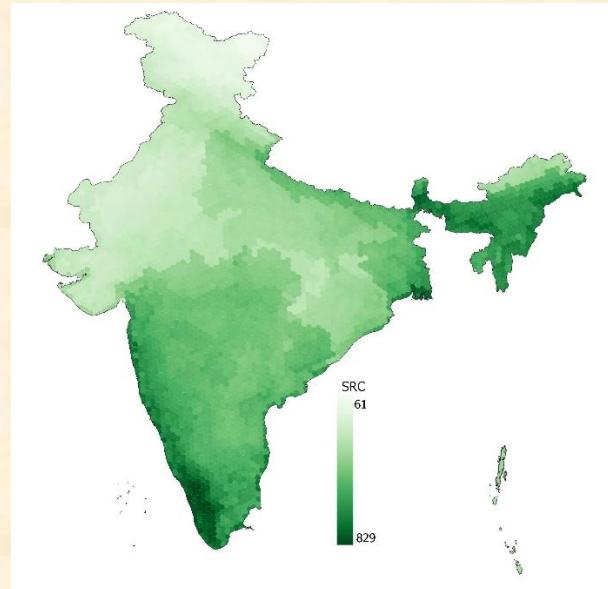
(c) Reptiles



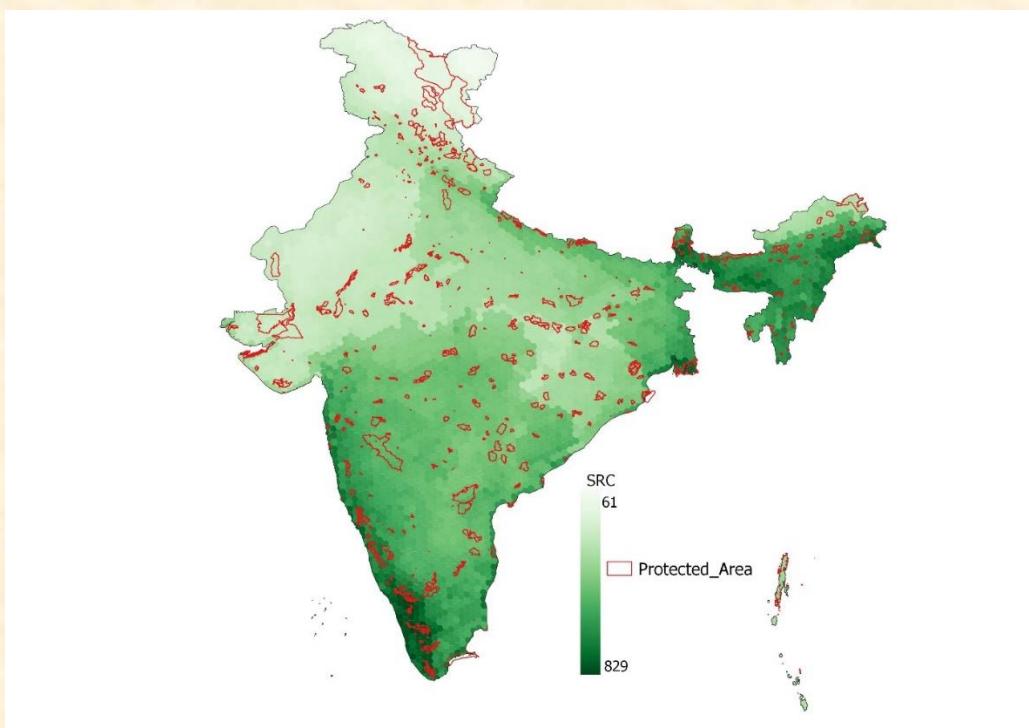
(d) Mangroves



(e) Fresh Water Group Species



(f) All Species



(g) Species Richness Map for All Species with Protected Area marked in Red
