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ijmrset@gmail.com



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LOSS OF WILD FAUNA DUE TO DEFORESTATION IN INDIA

DR. RENU DURGAPAL

PROFESSOR IN ZOOLOGY, GOVT. MS GIRLS COLLEGE, BIKANER, RAJASTHAN, INDIA

ABSTRACT: Deforestation in India is the widespread destruction of major forests in India. It is mainly caused by environmental degradation by stakeholders such as farmers, ranches, loggers and plantation corporations. In 2009, India ranked 10th worldwide in the amount of forest loss,^[1] where world annual deforestation is estimated as 13.7 million hectares (34×10^6 acres) a year

KEYWORDS-wild fauna, deforestation, India, loss, forests, environmental degradation

I. INTRODUCTION

Deforestation started with the growth of agriculture, but was exacerbated in the nineteenth century when British commercial forestry operations destroyed forests in mountain areas of Kerala, Tamil Nadu and Karnataka. The Gangetic plains have been almost completely deforested for agriculture.^[2]

Dynamics

Several causes supported deforestation, including colonization, agricultural expansion, firewood collection, timber harvesting and extension of cultivation on slopes. In the Indian Himalayas debris thrown down slopes due to reckless use of excavator machines for widening of roads and making of new roads has completely destroyed vast areas of Forest. Due to the colonization from all over the country trees are cut down as a primary source of fuel. These trees are used for cooking food and other daily needs which require fuel.

Results

Deforestation has affected the lives of wild animals and birds including bats.^[3] Due to deforestation India is facing water problems in urban cities and villages.

The overwhelming direct cause of deforestation is agriculture.^[6] More than 80% of deforestation was attributed to agriculture in 2018.^[7] Forests are being converted to plantations for coffee, tea, palm oil, rice, rubber, and various other popular products.^[8] Livestock ranching is another agricultural activity that drives deforestation. Further drivers are the wood industry (logging), economic development in general (for example urbanization), mining. The effects of climate change are another cause via the increased risk of wildfires.

Deforestation has resulted in habitat damage, biodiversity loss, and aridity. Deforestation also causes extinction, changes to climatic conditions, desertification, and displacement of populations, as observed by current conditions and in the past through the fossil record.^[9] Deforestation also reduces biosequestration of atmospheric carbon dioxide, increasing negative feedback cycles contributing to global warming. Global warming also puts increased pressure on communities who seek food security by clearing forests for agricultural use and reducing arable land more generally. Deforested regions typically incur significant other environmental effects such as adverse soil erosion and degradation into wasteland.

Agricultural expansion continues to be the main driver of deforestation and forest fragmentation and the associated loss of forest biodiversity.^[10] Large-scale commercial agriculture (primarily cattle ranching and cultivation of soya bean and oil palm) accounted for 40 percent of tropical deforestation between 2000 and 2010, and local subsistence agriculture for another 33 percent.^[10] Trees are cut down for use as building material, timber or sold as fuel (sometimes in the form of charcoal or timber), while cleared land is used as pasture for livestock and agricultural crops.



The vast majority of agricultural activity resulting in deforestation is subsidized by government tax revenue.^[89] Disregard of ascribed value, lax forest management, and deficient environmental laws are some of the factors that lead to large-scale deforestation.

India is the world's 8th most biodiverse region with a 0.46 BioD score on diversity index, 102,718 species of fauna and 23.39% of the nation's geographical area under forest and tree cover in 2020.^[1] India encompasses a wide range of biomes: desert, high mountains, highlands, tropical and temperate forests, swamplands, plains, grasslands, areas surrounding rivers, as well as island archipelago. Officially, three out of the 36 Biodiversity Hotspots in the world are present in India: the Himalayas, the Western Ghats, and the Indo-Burma region. To these may be added the Sundarbans and the Terai-Duar Savannah grasslands for their unique foliage and animal species.^[2] These hotspots have numerous endemic species.^[3] Nearly 5% of India's total area is formally classified under protected areas .

India, for the most part, lies within the Indomalayan realm, with the upper reaches of the Himalayas forming part of the Palearctic realm; the contours of 2000 to 2500m are considered to be the altitudinal boundary between the Indo-Malayan and Palearctic zones. India displays significant biodiversity. One of seventeen megadiverse countries, it is home to 7.6% of all mammalian, 12.6% of all avian, 6.2% of all reptilian, 4.4% of all amphibian and 11.7% of all fish.

The region is also heavily influenced by summer monsoons that cause major seasonal changes in vegetation and habitat. India forms a large part of the Indomalayan biogeographical zone and many of the floral and faunal forms show Malayan affinities with only a few taxa being unique to the Indian region. The unique forms includes the snake family Uropeltidae found only in the Western Ghats and Sri Lanka. Fossil taxa from the Cretaceous show links to the Seychelles and Madagascar chain of islands.^[4] The Cretaceous fauna include reptiles, amphibians and fishes and an extant species demonstrating this phylogeographical link is the purple frog. The separation of India and Madagascar is traditionally estimated to have taken place about 88 million years ago. However, there are suggestions that the links to Madagascar and Africa were present even at the time when the Indian subcontinent met Eurasia. India has been suggested as a ship for the movement of several African taxa into Asia. These taxa include five frog families (including the Myobatrachidae), three caecilian families, a lacertid lizard and freshwater snails of the family Pomatiopsidae.^[5] A thirty million year old Oligocene-era fossil tooth from the Bugti Hills of central Pakistan has been identified as from a lemur-like primate, prompting controversial suggestions that the lemurs may have originated in Asia.^{[6][7]} Lemur fossils from India in the past led to theories of a lost continent called Lemuria. This theory however was dismissed when continental drift and plate tectonics became well established.

India is home to several well-known large mammals, including the Asian elephant, Bengal tiger, Asiatic lion, Indian leopard and Indian rhinoceros. Some of these animals are engrained in Indian culture, often being associated with deities. These large mammals are important for wildlife tourism in India, with several national parks and wildlife sanctuaries catering to these needs. The popularity of these charismatic animals have greatly helped conservation efforts in India. The tiger has been particularly important, and Project Tiger, started in 1972, was a major effort to conserve the tiger and its habitats.^[8] Project Elephant, though less known, started in 1992 and works for elephant protection.^[9] Most of India's rhinos today survive in the Kaziranga National Park.

Some other well-known large Indian mammals are ungulates such as the 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. It is also home to the striped hyena. Many smaller animals such as macaques, langurs and mongoose species are especially well known due to their ability to live close to or inside urban areas.

Fauna of India

The Zoological Survey of India (ZSI), with its headquarters in Kolkata (the capital of West Bengal) and 16 regional stations is responsible for surveying the faunal resources of India. Possessing a tremendous diversity of climate and physical conditions, India has great variety of fauna, numbering 89,451 species.

The mammals include the Indian elephant, the gaur or erroneously the Indian bison - the largest of existing bovines, the great Indian rhinoceros, and the wild water buffalo. Deer and antelopes include the barasingha, the sangai, chital, sambar deer, Indian hog deer, Himalayan musk deer, Indian muntjac, Indian spotted chevrotain, Kashmir stag, Tibetan antelope, blackbuck, chausingha, goa, Indian gazelle, and nilgai. There are also wild



donkeys like Indian wild ass and kiang, and caprines like Bhutan takin, Mishmi takin, red serow, Himalayan serow, red goral, Himalayan goral, markhor, Siberian ibex, Nilgiri tahr, Himalayan tahr, urial, argali, and blue sheep. These caprines are generally found in the Himalayas of Himachal Pradesh, Ladakh, and Jammu and Kashmir (union territory), as well as the Dooars forest and the Terai region, floodplains at the base of the Himalayas. A notable exception is the Nilgiri tahr which is endemic to the Nilgiri Hills of Tamil Nadu. There are several big cats; the Asiatic lion, Bengal tiger, Indian leopard, snow leopard, clouded leopard, Eurasian lynx and caracal. Lesser cat species include fishing cat, Asiatic wildcat, jungle cat, Pallas's cat, Bengal cat, marbled cat, Asian golden cat, and leopard cat. There are also canines such as Ussuri dhole, Indian jackal, Indian wolf, Bengal fox, Tibetan wolf, and Tibetan fox. Another carnivore is the striped hyena. Several birds, like greater flamingos, Brahminy ducks, white-breasted waterhen, pheasant-tailed jacana, Eurasian spoonbills, lesser flamingos, purple herons, great and cattle egret, Indian pond herons, oriental magpie-robins, Nicobar pigeons, Indian mynas, Indian rollers, slaty-breasted rails, greater coucals, black-bellied terns, Indian pittas, Indian paradise flycatchers, sarus cranes, Siberian cranes, demoiselle cranes, great hornbills, rose-ringed parakeets, vernal hanging parrots, knob-billed ducks, painted storks, and Asian openbills inhabit forests, wetlands, and mountains. The Indian peafowl is the national bird of India, and is also found in white and mixed varieties. Pheasants include red junglefowl, grey junglefowl, Himalayan monals, satyr tragopans, and kalij pheasants; the great Indian bustard is also common in grasslands. Predatory birds include the Northern goshawk, shikra, black kite, white-bellied sea eagle, golden eagle, peregrine falcon, Indian vulture, slender-billed vulture, and white-backed vulture. The house crow and Indian jungle crow are some crow species in India. Chestnut-bellied sandgrouse is a sandgrouse found in India. There are plenty of small mammals in India. These include the Asian house shrew, the northern and greater hog badger, the Chinese ferret-badger, the honey badger, the Indian pangolin, and the Chinese pangolin. Arboreal small mammals include the Nilgiri marten, small-toothed palm civet, Asian palm civet, small Indian civet, large Indian civet, binturong, and red panda. The bears of India are sun bear, sloth bear, Himalayan black bear, and Himalayan brown bear. There are also many primates in India. The apes of India are the gibbons; western hoolock gibbon and eastern hoolock gibbon. Macaques include rhesus macaque, bonnet macaque, lion-tailed macaque, Northern pig-tailed macaque, stump-tailed macaque, Arunachal macaque, white-cheeked macaque and Assamese macaque among others. The various species of langurs include purple-faced langur, the Nilgiri langur, the Gee's golden langur and capped langur. There is also the Phayre's leaf monkey. The suids in India are Indian boar and the critically endangered pygmy hog. There are lagomorphs like the critically endangered hispid hare, the woolly hare and the black-naped hare. The Royle's pika and Himalayan marmot are some of the montane small mammals. There is also the large Malabar giant squirrel, Indian palm squirrel, Indian gerbil, porcupine species Indian crested porcupine and hedgehog species bare-bellied hedgehog and Indian hedgehog. Another predator in India is the spotted linsang, a civet-like creature.

Many are domesticated in India, and seeing them in the streets of villages and even cities is common. Bovines include the zebu, which descended from the extinct Indian aurochs, the domestic water buffalo, the gayal, which is a domesticated gaur, and in the northern regions domestic yak, which descended from the also native wild yak. Dromedary camel can be found in desert states like Rajasthan, Gujarat, and Punjab. Mongrel dogs are a common sight in most cities of India. Other small mammals found throughout urban areas are several species of mongoose and white-tailed mole. These mongoose species are ruddy mongoose, Indian grey mongoose, Indian brown mongoose, small Indian mongoose, stripe-necked mongoose, and crab-eating mongoose. The desert locust is infamous for destroying crops.

Rivers and lakes harbour mugger crocodiles and gharials. The saltwater crocodile is found along the eastern coast and in the Andaman and Nicobar Islands. A project for breeding crocodiles, started in 1974, has been instrumental in saving the crocodile from extinction. Snakes include king cobra, Indian cobra, monocled cobra, Indian rock python, reticulated python, Sri Lankan green vine snake, Brahminy blind snake, green pit viper, Salazar's pit viper, Russell's viper, saw-scaled viper and Indian krait. The cobras are an important part of Indian culture. Frogs include purple frog, Chunam tree frog, Indus Valley bullfrog, and Indian green frog. A notable newt is the Himalayan newt; it is the only salamander in India. There are also caecilian species, like the yellow-striped caecilian. India's coasts are full of sea turtles; these include the leatherback sea turtle, green sea turtle, hawksbill sea turtle, loggerhead sea turtle, and olive ridley sea turtle. Indian softshell turtles and Indian flapshell turtles are found in mangrove vegetation, lagoons, and freshwater and brackish bodies. The Asian water monitor and Bengal monitor are the monitor lizards in India; there are also several gecko species like the golden gecko, and the only chameleon, Indian chameleon.

Fish are a major part of the Indian economy. The fish include tilapia, Atlantic pomfret, hilsa, barramundi, rohu, largemouth sawfish, Pearse's mudskipper, giant oceanic manta ray, leopard torpedo,



among thousands of others. Hilsa and barramundi are important in the fishing industry of India, especially in West Bengal. These also include sharks, such as thresher shark, great white shark, mako shark, hammerhead shark, tiger shark, and sand tiger shark. Bull sharks and Ganges sharks are also found in freshwater areas and brackish areas such as the Sundarbans National Park, part of the world's largest mangrove forest the Sundarbans. Remora are commonly found attached to these sharks. Coral reefs in India are rich in fish such as angelfish, clownfish, powder blue tang, pufferfish, parrotfish, moray eel, Chinese trumpetfish, redtoothed triggerfish, and butterfly fish.

Marine dolphins along the coast of India include bottlenose dolphin, common dolphin, and pantropical spotted dolphin among others. Finless porpoise are found along the coast as well. The endangered Irrawaddy dolphin is found in freshwater areas, such as Chilika Lake, alongside the Ganges river dolphin and Indus river dolphin. Blue whales, humpback whales, sperm whales, dwarf sperm whales, orcas, Cuvier's beaked whales, and pygmy killer whales are the most common whales. The semi-aquatic mammals in India are otters. The species of otters are Asian small-clawed otter, Eurasian otter, and smooth-coated otter. The increasingly endangered dugong is found throughout coastal estuaries and brackish water bodies.

A notable dragonfly is the Himalayan relict dragonfly. India is also known for its butterflies, such as lesser grass blue, common blue Apollo, common mime, common Mormon, and common Pierrot. The orchid mantis is an iconic mantis found in the Western Ghats of India. Laboratory stick insects and leaf insects are found in abundance.

Stegodon elephants, Indosaurus, Himalayan quail, and pink-headed duck are famous extinct animals from India. The Himalayan quail and pink-headed duck are only presumed extinct. However, there are other quails such as rain quail in India, and the pink-headed duck's relative the Indian spot-billed duck.

Depletion of vegetative cover due to expansion of agriculture, habitat destruction, over-exploitation, pollution, introduction of toxic imbalance in community structure, epidemics, floods, droughts and cyclones, contribute to the loss of flora and fauna. More than 39 species of mammals, 72 species of birds, 17 species of reptiles, three species of amphibians, two species of fish, and a large number of butterflies, moth, and beetles are considered vulnerable and endangered.^[10]

Biodiversity

India is listed 12th among the mega-biodiverse nations in the world with a BioD score of 0.46 on the diversity index "which is calculated by its percentage of species in each group relative to the total global number of species in each group". With 23.39% of its geographical area under forest and tree cover, India is rich in biodiversity. A 2020 faunal survey of India by the Zoological Survey of India (ZSI) reported a total of 102,718 species of fauna, with 557 new species including 407 newly described species and 150 new country records. Among the new finds, 486 species were invertebrates (mostly insects), and 71 were vertebrate species, mostly fishes and reptiles. New species were reported from Karnataka (66 species), Kerala (51), Rajasthan (46) and West Bengal (30). From 2010 to 2020, 4,112 species, including 2,800 new species and 1,312 new records, were added to the Indian fauna.^[11]

There is insufficient information about the invertebrate fauna of India, with significant work having been done only in a few groups of insects, notably the butterflies, Odonata and Hymenoptera, mostly in *The Fauna of British India, Including Ceylon and Burma* series.

There are about 2,546 species of fishes (about 11% of the world species) found in Indian waters. About 197 species of amphibians (4.4% of the world total) and more than 408 reptile species (6% of the world total) are found in India. Among these groups the highest levels of endemism are found in the amphibians.

There are about 1361 species of birds recorded from India, with some variations, depending on taxonomic treatments, accounting for about 12% of the world species.^[11]

There are about 410 species of mammals known from India, which is about 8.86% of the world species.^[12]

India has the greatest number of cat species in the world.^[13]

The World Conservation Monitoring Centre gives an estimate of about 15,000 species of flowering plants in India.



Biodiversity hotspots

The Western Ghats

The Western Ghats are a chain of hills that run along the western edge of peninsular India. Their proximity to the ocean and through orographic effect, they receive high rainfall. These regions have moist deciduous forest and rain forest. The region shows high species diversity as well as high levels of endemism. Nearly 77% of the amphibians and 62% of the reptile species found here are found nowhere else.^[14] The region shows biogeographical affinities to the Malayan region, and the Satpura hypothesis proposed by Sunder Lal Hora suggests that the hill chains of Central India may have once formed a connection with the forests of northeastern India and into the Indo-Malayan region. Hora used torrent stream fishes to support the theory, but it was also suggested to hold for birds.^[15] Later studies have suggested that Hora's original model species were a demonstration of convergent evolution rather than speciation by isolation.^[14]

More recent phylogeographic studies have attempted to study the problem using molecular approaches.^[16] There are also differences in taxa which are dependent on time of divergence and geological history.^[17] Along with Sri Lanka this region also shows some fauna similarities with the Madagascan region especially in the reptiles and amphibians. Examples include the *Sinophis* snakes, the purple frog and Sri Lankan lizard genus *Nessia* which appears similar to the Madagascan genus *Acontias*.^[18] Numerous floral links to the Madagascan region also exist.^[19] An alternate hypothesis that these taxa may have originally evolved out-of-India has also been suggested.^[20]

Bio geographical quirks exist with some taxa of Malayan origin occurring in Sri Lanka but absent in the Western Ghats. These include insects groups such as the plants such as those of the genus *Nepenthes*.

The Eastern Himalayas

The Eastern Himalayas is the region encompassing Bhutan, northeastern India, West Bengal, and southern, central and eastern Nepal. The region is geologically young and shows high altitudinal variation. It has nearly 163 globally threatened species including the one-horned rhinoceros (*Rhinoceros unicornis*), the Wild Asian water buffalo (*Bubalus bubalis* (*Arnee*)) and in all 45 mammals, 50 birds, 17 reptiles, 12 amphibians, 3 invertebrate and 36 plant species.^{[21][22]} The Dooars forest in the Terai is a biologically diverse area, with Himalayan biodiversity as well as tropical biodiversity. The relict dragonfly (*Epiophlebia laidlawi*) is an endangered species found here with the only other species in the genus being found in Japan. The region is also home to the Himalayan newt (*Tylototriton verrucosus*), the only salamander species found within Indian limits.^[23]

Extinct and fossil forms

During the early Tertiary period, the Indian tableland, what is today peninsular India, was a large island. Prior to becoming an island, it was connected to the African region. During the tertiary period, this island was separated from the Asian mainland by a shallow sea. The Himalayan region and the greater part of Tibet lay under this sea. The movement of the Indian subcontinent into the Asian landmass created the great Himalayan ranges and raised the sea bed into, what is today, the plains of northern India.

Once connected to the Asian mainland, many species moved into India. The Himalayas were created in several upheavals. The Siwaliks were formed at the last and the largest number of fossils of the Tertiary period are found in these ranges.^[24]

The Siwalik fossils include mastodons, hippopotamus, rhinoceros, sivatherium, a large four-horned ruminant, giraffe, horses, camels, bison, deer, antelope, gorillas, pigs, chimpanzees, orangutans, baboons, langurs, macaques, cheetahs, sabre-toothed cats, lions, tigers, sloth bear, Aurochs, leopards, wolves, dholes, porcupines, rabbits and a host of other mammals.^[24]

II. DISCUSSION

The overwhelming direct cause of deforestation is agriculture.^[6] Subsistence farming is responsible for 48% of deforestation; commercial agriculture is responsible for 32%; logging is responsible for 14%, and fuel wood removals make up 5%.^[6]



More than 80% of deforestation was attributed to agriculture in 2018.^[7] Forests are being converted to plantations for coffee, tea, palm oil, rice, rubber, and various other popular products.^[8] The rising demand for certain products and global trade arrangements causes forest conversions, which ultimately leads to soil erosion.^[9] The top soil oftentimes erodes after forests are cleared which leads to sediment increase in rivers and streams.

Most deforestation also occurs in tropical regions. The estimated amount of total land mass used by agriculture is around 38%.^[92]

Another prevalent method of agricultural deforestation is slash-and-burn agriculture, which was primarily used by subsistence farmers in tropical regions but has now become increasingly less sustainable. The method does not leave land for continuous agricultural production but instead cuts and burns small plots of forest land which are then converted into agricultural zones. The farmers then exploit the nutrients in the ashes of the burned plants.^{[95][96]} As well as, intentionally set fires can possibly lead to devastating measures when unintentionally spreading fire to more land, which can result in the destruction of the protective canopy.^[97]

The repeated cycle of low yields and shortened fallow periods eventually results in less vegetation being able to grow on once burned lands and a decrease in average soil biomass.^[98] In small local plots sustainability is not an issue because of longer fallow periods and lesser overall deforestation. The relatively small size of the plots allowed for no net input of CO₂ to be released.^[99]

Deforestation on a human scale results in decline in biodiversity,^[192] and on a natural global scale is known to cause the extinction of many species.^{[9][193]} The removal or destruction of areas of forest cover has resulted in a degraded environment with reduced biodiversity.^[118] Forests support biodiversity, providing habitat for wildlife;^[194] moreover, forests foster medicinal conservation.^[195] With forest biotopes being irreplaceable source of new drugs (such as taxol), deforestation can destroy genetic variations (such as crop resistance) irretrievably.^[196]

Since the tropical rainforests are the most diverse ecosystems on Earth^{[197][198]} and about 80% of the world's known biodiversity can be found in tropical rainforests,^{[199][200]} removal or destruction of significant areas of forest cover has resulted in a degraded^[201] environment with reduced biodiversity.^{[9][202]} Road construction and development of adjacent land, which greatly reduces the area of intact wilderness and causes soil erosion, is a major contributing factor to the loss of biodiversity in tropical regions.

Many fossil tree species have been found in the intertrappean beds,^[25] including *Grewioxylon* from the Eocene and *Heritioxylon keralensis* from the middle Miocene in Kerala and *Heritioxylon arunachalensis* from the Miocene of Arunachal Pradesh and at many other places. The discovery of *Glossopteris* fern fossils from India and Antarctica led to the discovery of Gondwanaland and led to the greater understanding of continental drift. Fossil *Cycads*^[26] are known from India while seven *Cycad* species continue to survive in India.^{[27][28]}

Titanosaurus indicus was perhaps the first dinosaur discovered in India by Richard Lydekker in 1877 in the Narmada valley. This area has been one of the most important areas for paleontology in India. Another dinosaur known from India is *Rajasaurus narmadensis*,^[29] a heavy-bodied and stout carnivorous abelisaurid (theropod) dinosaur that inhabited the area near present-day Narmada river. It was 9 m in length and 3 m in height and somewhat horizontal in posture with a double-crested crown on the skull.

Some fossil snakes from the Cenozoic era are also known.^[30]

Some scientists have suggested that the Deccan lava flows and the gases produced were responsible for the global extinction of dinosaurs. However, these have been disputed.^{[31][32]}

Himalayacetus subathuensis, the oldest-known whale fossil of the family Protocetidae (Eocene), about 53.5 million years old was found in the Simla hills in the foothills of the Himalayas. This area was underwater (in the Tethys sea) during the Tertiary period (when India was an island off Asia). This whale may have been capable of living partly on land.^{[33][34]} Other fossil whales from India include *Remingtonocetus* approximately 43-46 million years old.

Several small mammal fossils have been recorded in the intertrappean beds, however larger mammals are mostly unknown. The only major primate fossils have been from the nearby region of Myanmar.



Recent extinctions

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.

Probably the first species to vanish during the time of the Indus Valley civilisation was the species of wild cattle, *Bos primegenius nomadicus* or the wild zebu, which vanished from its range in the Indus valley and western India, possibly due to inter-breeding with domestic cattle and resultant fragmentation of wild populations due to loss of habitat.^[35]

Notable mammals which became or are presumed extinct within the country itself include the Indian / Asiatic cheetah, Javan rhinoceros and Sumatran rhinoceros.^[36] 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. Many species have not been seen since their description. *Hubbardia heptaneuron*, a species of grass that grew in the spray zone of the Jog Falls prior to the construction of the Linganamakki reservoir, was thought to be extinct but a few were rediscovered near Kolhapur.^[37]

Some species of birds have gone extinct in recent times, including the pink-headed duck (*Rhodonessa caryophyllacea*) and the Himalayan quail (*Ophrysia superciliosa*). A species of warbler, *Acrocephalus orinus*, known earlier from a single specimen collected by Allan Octavian Hume from near Rampur in Himachal Pradesh was rediscovered after 139 years in Thailand.^{[38][39]} Similarly, the Jerdon's courser (*Rhinoptilus bitorquatus*), named after the zoologist Thomas C. Jerdon who discovered it in 1848, was rediscovered in 1986 by Bharat Bhushan, an ornithologist at the Bombay Natural History Society after being thought to be extinct.

III. RESULTS

It has been estimated that 137 plant, animal and insect species go extinct every day due to rainforest deforestation, which equates to 50,000 species a year.^[204] Scientific understanding of the process of extinction is insufficient to accurately make predictions about the impact of deforestation on biodiversity.^[209] Most predictions of forestry related biodiversity loss are based on species-area models, with an underlying assumption that as the forest declines species diversity will decline similarly.^[210] However, many such models have been proven to be wrong and loss of habitat does not necessarily lead to large scale loss of species.^[210] Species-area models are known to overpredict the number of species known to be threatened in areas where actual deforestation is ongoing, and greatly overpredict the number of threatened species that are widespread.^[208]

The degradation and loss of forests disrupts nature's balance.^[10] Indeed, deforestation eliminates a great number of species of plants and animals which also often results in an increase in disease,^[215] and exposure of people to zoonotic diseases.^{[10][216][217][218]} Deforestation can also create a path for non-native species to flourish such as certain types of snails, which have been correlated with an increase in schistosomiasis cases.^{[215][219]}

Forest-associated diseases include malaria, Chagas disease (also known as American trypanosomiasis), African trypanosomiasis (sleeping sickness), leishmaniasis, Lyme disease, HIV and Ebola.^[10] The majority of new infectious diseases affecting humans, including the SARS-CoV-2 virus that caused the COVID-19 pandemic, are zoonotic and their emergence may be linked to habitat loss due to forest area change and the expansion of human populations into forest areas, which both increase human exposure to wildlife.^[10]

India is home to a large variety of wildlife. It is a biodiversity hotspot with various ecosystems ranging from the Himalayas in the north to the evergreen rainforests in the south, the sands of the west to the marshy mangroves of the east. India lies within the Indomalayan realm and is home to about 7.6% of mammal, 14.7% of amphibian, 6% of bird, 6.2% of reptilian, and 6.2% of flowering plant species.^[1] India's forests contain about 500 species of mammals and more than 1300 bird species.

India is one of the most biodiverse regions of the world and includes three of the world's 36 biodiversity hotspots – the Western Ghats, the Eastern Himalayas, and the Indo-Burma hotspot.^{[2][3]} It is one of the 17 megadiverse countries. The country has 12 biosphere reserves and 75 Ramsar sites.

In response to a decrease in the numbers of wild animals, human encroachment and poaching activities, the Government of India established a system of national parks and protected areas in 1935, which subsequently



expanded. In 1972, India enacted the Wildlife Protection Act of 1972 and Project Tiger to safeguard crucial habitat. Further federal protections were promulgated in the 1980s.

India has about 2,714 endemic lichen species. In 2020, the Lichen Park in India was developed by the Uttarakhand Forest Department in Munsiyari.^[4]

Geographic origins

Many Indian species are descendants of species originating in Gondwana, of which India originally was a part. Peninsular India's subsequent movement towards, and collision with, the Laurasian landmass set off a mass exchange of species. However, volcanism in the Deccan Traps and climatic change 20 million years ago caused the extinction of many endemic Indian forms.^[5] Soon thereafter, mammals entered India from Asia through two zoogeographical passes on either side of the emerging Himalayas.^[6] As a result, among Indian species, only 12.6% of mammals and 4.5% of birds are endemic, contrasting with 45.8% of reptiles and 55.8% of amphibians.^[1] Notable endemics are the Nilgiri langur and the brown and carmine Beddome's toad of the Western Ghats. India harbours 172, or 2.9%, of IUCN-designated threatened species.^[7] India is located at the junction of three biogeographic realms: the Afrotropical, Indomalayan and Palearctic, and therefore, has characteristic elements from each of them, spurring migration of avifauna from these regions.

Fauna

India is home to several well-known large animals, including the Indian elephant,^[8] Indian rhinoceros,^[9] Bengal tiger,^[10] Asiatic lion,^[11] Indian leopard,^[12] snow leopard,^[13] and clouded leopard.^[14] Bears include sloth bear, sun bear, the Himalayan black bear, the Himalayan brown bear, and deer and antelopes include the chausinga antelope, the blackbuck, chinkara gazelle, chital, sambar, sangai, nilgai, Tibetan antelope, goa, Kashmir stag, musk deer, Indian muntjac, Indian hog deer, and the barasinga. It is home to big cats like Bengal tiger, Asiatic lion, Indian leopard, snow leopard, caracal, Eurasian lynx and clouded leopard. Various species of caprines, including Bhutan and Mishmi takin, Himalayan and red goral, Himalayan serow, red serow, Himalayan tahr, Siberian ibex, markhor, and Nilgiri tahr, as well as the kiang and Indian wild ass. Wild sheep include blue sheep and argali. Gaur, wild water buffalo, wild yak, zebu, and gayal are also found. Small mammals include Indian crested porcupine, Indian boar, pygmy hog, Nilgiri marten, palm civet,^[specify] red panda, binturong, and hog badger. Canidae include Tibetan and Bengal fox, Himalayan and Indian wolf, Ussuri dhole and Indian jackal. It is also home to the striped hyena. Aquatic mammals include Ganges river dolphin and finless porpoise. Reptiles include king cobra, Indian cobra, bamboo pit viper, Sri Lankan green vine snake, common krait, Indian rock python, Burmese python, reticulated python, mugger crocodile, gharial, saltwater crocodile and Indian golden gecko. Notable amphibians include the purple frog, Indian tree frog and Himalayan newt. Birds include Indian peacock, great Indian hornbill, great Indian bustard, ruddy shelduck, Himalayan monal, Himalayan quail, painted stork, greater and lesser flamingo, and Eurasian spoonbill.^{[15][16]}

Flora

There are about 18,500 species of flowering plants in India. The Indian Forest Act, 1927 helped to improve the protection and security of the natural habitat. Many ecoregions, such as the *shola* forests, also exhibit extremely high rates of endemism; overall, 33% of Indian plant species are endemic.^[17] Forests range from the tropical rainforest of the Andaman Islands, Western Ghats, and Northeast India to the coniferous forest of the Himalayas. Between these extremes lie the sal-dominated moist deciduous forest of eastern India; teak-dominated dry deciduous forest of central and southern India, and the babul-dominated thorn forest of the central Deccan and western Gangetic plain.^[6] Mangrove forests such as the Sundarbans are on the coasts of West Bengal and Odisha. Important Indian trees include the medicinal neem, widely used in rural Indian herbal remedies. Bamboo gardens are extremely common in jungles as well as villages. States like Sikkim and West Bengal have orchids. The national flower of India, the lotus, is common in lakes and ponds.

Fungi

One-third of the fungal diversity of the globe exists in India. Only a fraction of the fungi of India have been subjected to scientific scrutiny. Over 27,000 species have been recorded in India, making it the largest biotic community after insects. About 205 genera have been described from India, of which 32% were discovered by C. V. Subramanian of the University of Madras.^{[18][19]}



Conservation

Article 48 of the Constitution of India says, "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."^[20] The committee in the Indian Board for Wildlife, in their report, defines wildlife as "the entire natural uncultivated flora and fauna of the country" while the Wildlife Protection Act, 1972 defines it as "any animal, bees, butterflies, crustacea, fish, moths and aquatic or land vegetation which forms part of any habitat."^[21]

Despite the various environmental issues, the country still has rich and varied wildlife.^[21]

As of 2020, there are 981 protected areas including 106 national parks, 566 wildlife sanctuaries, 97 conservation reserves and 214 community reserves. In addition, there are 51 tiger reserves, 18 biosphere reserves and 32 elephant reserves. Hundreds of India's bird species are in serious decline, according to a study spanning over 25 years.^[22] In 2020 the Indian government created the world's first sea cucumber reserve in Lakshadweep – Dr KK Mohammed Koya Sea Cucumber Conservation Reserve, the largest marine conservation reserve – Attakoya Thangal Marine Reserve and the first protected area for marine birds in India – PM Sayeed Marine Birds Conservation Reserve.^[23]

Gir forest in India has the only surviving population of Asiatic lions in the world. In the late 1960s, there were only about 180 Asiatic lions. There were more than 600 Asiatic lions in Gir National Park in 2018.^[24]

Extinctions in recent times

Some bird species have gone extinct in recent times, including the pink-headed duck (*Rhodonessa caryophyllacea*) and the Himalayan quail (*Ophrysia superciliosa*). The large-billed reed warbler (*Acrocephalus orinus*), known from a single specimen collected by Allan Octavian Hume from near Rampur in Himachal Pradesh, was rediscovered in Thailand after 139 years.^{[25][26]}

The Asiatic cheetah became extinct in India in the 1950s. India's last recorded cheetah in the wild was said to have been shot in the Rewa area of Madhya Pradesh in the late 1940s.

IV. CONCLUSION

Different cultures of different places in the world have different interpretations of the actions of the cutting down of trees. For example, in Meitei mythology and Meitei folklore of Manipur (India), deforestation is mentioned as one of the reasons to make mother nature weep and mourn for the death of her precious children. The varied and rich wildlife of India has had a profound impact on the region's culture. India's wildlife has been the subject of numerous tales and fables such as the *Panchatantra* and the *Jataka Tales*. Notions of the wildlife of India were introduced in the West and made famous in the late 1800s by Rudyard Kipling, especially through *The Jungle Book*.

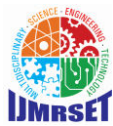
National animals

Indian peacock

- National animal: tiger
- National heritage animal: Indian elephant
- National aquatic animal: South Asian river dolphin^[27]
- National bird: Indian peacock
- National reptile: king cobra

Biosphere reserves

The Indian government has established 18 biosphere reserves, which protect larger areas of natural habitat and often include one or more national parks or reserves, along with 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.



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