

Ecoregion

# East Deccan Moist Deciduous Forests



**Area of the ecoregion**  
399,443 km<sup>2</sup>



**Altitude**  
50-1670m



**Annual rainfall**  
600 – 3450 mm



**Temperature**  
-2°C – 45°C



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## Overview

The East Deccan Moist Deciduous Forests is a prominent ecoregion with vast tracts of highland sal (*Shorea robusta*) dominated semi-evergreen forests, forming a diverse interface between the dry deciduous forests of the Eastern Ghats and central India. The interconnected belts of protected areas, buffer zones, and animal corridors cover a third of the land area, creating some of the largest stands of remnant forests in India that have been less-disturbed historically by development and intrusions. The broad highland regions have a complex geology and topography and feed several perennial streams and large river systems, including parts of the Godavari and Mahanadi basins, which sustain millions of people. The diverse forests and old-growth grassland ecosystems sustain diverse indigenous tribal communities still strongly reliant upon the landscape and its resources.

## Adjoining ecoregions

The **Narmada Valley Dry Deciduous Forests** and the **Central Deccan Dry Deciduous Forests** lie to the west; the latter wrapping around the southern extents of this region. To the north east this ecoregion conjoins the **Chhota - Nagpur Dry Deciduous Forests** and the **Lower Gangetic Plain Moist Deciduous Forests**. Towards the eastern coast it abuts the **Orissa Semi Evergreen Forests** and the **Krishna-Godavari Mangroves**. This ecoregion completely surrounds the **North Deccan Dry Deciduous Forests**, which lies in its interior.



A view of leaf flush and undulating dense forest, Burki Sada, Satpura

## Geography

This ecoregion extends as a broad belt of forests covering an area of 399,443 km<sup>2</sup>. Situated primarily in Madhya Pradesh, Chhattisgarh, and Orissa, but extending into Telangana, Andhra Pradesh, and Jharkhand, more than 30% of the area is still under forest cover. The region extends 778 km from the Godavari river basin in the south to the Subarnarekha river basin up north and spans a breadth of 950 km. The northern rim of the ecoregion includes the Pachmarhi hills of the Satpuras, extending eastwards as the Maikal and Amarkantak ranges and blending with the eastern Vindhyas. On the south and east it includes and ranges from Araku and the Eastern Ghats of Odisha through Satkosia to the Saranda – Singhbhum ranges. The landscape is marked by broad and extensive geologically-complex plateaus and highlands upto 1670 m elevation (Deomali peak), interspersed by broad floodplains and steep ravines fed by numerous streams. Major fluvial systems and basins include the eastward-flowing Godavari, Nagavali, Bansadhara, Mahanadi, Brahmani, Baitarani, and Subarnarekha rivers. The ecoregion has many large protected areas interconnected by buffer zone tracts and important animal corridors and reserved forests with relatively few linear intrusions. The forests have been long peopled historically by indigenous tribal populations still residing in these areas, including small-scale agrarian tribes (e.g., Santal, Bhumija, Bhuiyan, Ho, and Gond) besides hunter-gatherer communities (e.g., Kharia, Mankidia, and Sabhara).

## Geology and Soil

The underlying geological horizons of this ecoregion have multiple geological structures and chemical compositions divided by linear laminar layers. The underlying bedrock is made up primarily of the stratified or vesicular basalt part of the larger Deccan Trap system, but can also be composed of high-grade gneiss in some southern regions. This layer is followed by a deeply-weathered layer of paleosols that gives way to a broader horizon of flat-bedded black shale. The shale layer has laminae holding lignite or bitumen-like organic matter compounds and also networks of iron ore. The black shale is interspersed with large carbon deposits with a high abundance of pyrite crystals. This layer is followed by a broad bed of marlstone followed by partially chertified limestone holding a high density of calcified marine and intertidal fossils. Sitting atop this complex mosaic of composites is a layer of deeply weathered lateritic basalt



Trees–Canopy[left to right]: *Shorea robusta*, *Crateva religiosa*, *Schrebera swietenoides*, *Symplocos cochinchinensis*, *Hymenodictyon excelsum*



Trees–Sub–canopy[left to right]: *Casearia graveolens*, *Ficus palmata*, *Gardenia turgida*, *Trema orientalis*



Shrubs[left to right]: *Caesalpinia bonducella*, *Glycosmis pentaphylla*, *Capparis spinosa*, *Flacourtia indica*



Climbers/Lianas[left to right]: *Cryptolepis buchanani*, *Dioscorea bulbifera*, *Gnetum edule*, *Entada rheedii*

or charnockite extrusions that contains high concentrations of zeolitic or quartzitic crystals that then lead to either ferruginous leached soils or most often fertile, rich black cotton soils. Along larger river basins and perennial streams significant alluvial loam deposits can be found with fine and dense clay that accumulate from the weathering and erosion of the highland regions.

## **Climate**

The tropical climate is distinctly humid for the majority of the year averaging 90% humidity for around 8 months, while the driest months span the winter between November and February. Temperatures can fluctuate between extremes, from as low as  $-2^{\circ}$  to  $45^{\circ}$  but averages  $25^{\circ}$  -  $32^{\circ}$ . Most rainfall is received through the southwest monsoons (July – August) but significant rainfall occurs during cyclonic events of the north-east monsoon. Total annual rainfall is about 1400 mm across the ecoregion, but there is considerable variation in precipitation gradients related to the topography, geography, and between years (ranging between 600 and 3450 mm). Extensive dew fall between December and March, characteristic of this ecoregion, plays an important role in vegetation dynamics. The number of rainy days averages about 100 per year, including days with convective thundershowers during the intense radiation of the summer months. Perennial streams and large subsurface and surface fluvial systems reduce the seasonality and dry period extremes seen in the surrounding dry deciduous forest belts.



Barehipani waterfall, Similipal Biosphere Reserve

## Natural vegetation

The natural vegetation of this ecoregion includes tall multi-storeyed moist deciduous forests interspersed with semi-evergreen forest stands. The structure includes a main canopy (20 – 35 m height) dominated by species such as sal which forms large dense stands; the 10 most dominant species make up 66% of the main canopy. The sub-canopy (8 – 15 m) holds a more diverse set of brevi-deciduous and evergreen species and other flora more specialised to local factors such as soil, elevation, rainfall, and exposure to radiation. Finally, there is a more loosely-defined and variable understorey (upto 5 m) with shrubs, pteridophytes, and also grasses and herbs. Pockets also hold high densities of lianas/climbers but their distribution is variable. The tree density of the East Deccan Moist Deciduous Forests is relatively higher than the dry deciduous counterparts surrounding this region, varying between 568 – 970 trees per hectare. Old growth semi-evergreen forests may have a lower density of trees but are structurally distinct with taller, larger trees. Mature or old-growth tropical grassland ecosystems are less widespread in this ecoregions compared to the central Deccan and found in specialised pockets along the exposed slopes of the highland plateaus, along waterlogged riverine stretches, and forest edges.

During the Maastrichtian age (late Cretaceous epoch), the forests of this ecoregion predominantly (54%) had a highly diverse tropical and sub-tropical evergreen rainforest type forming a contiguous biological bridge between the rainforests of the Western Ghats and the dipterocarp forests of Northeast India. Due to subsequent aridification and climatic change the forests of the east Deccan have transitioned into a deciduous seasonal type. However the forests share many similarities in species composition and structure with the North and South Western Ghats Moist Deciduous Forests making this a bio-geographically distinct and prominent zone.

## Variation within ecoregion

The wide span, complex topography (of highlands, ravines and basins) large area and array of 'arms' that extend into other ecoregions and unique landscapes, and variation in microclimates creates a high diversity and variation of forest and ecosystem type within the East Deccan Moist Deciduous Forests. A macroscale driver of variation is distance from the east coast. Land and forests closer to the coast are more moist, less seasonal in rainfall, more humid and warmer. Areas closer to the coast are of lower elevation and typified by broader fluvial basins and estuaries and are geologically

# Characteristic native plant species

## Trees

### Canopy

*Alangium salviifolium*  
*Albizia procera*  
*Anogeissus latifolia*  
*Anthocephalus cadamba*  
*Artocarpus lacucha*  
*Barringtonia acutangula*  
*Boswellia serrata*  
*Crateva religiosa*  
*Croton oblongifolia*  
*Dalbergia sisoo*  
*Dillenia pentagyna*  
*Diospyros malabarica*  
*Ficus benghalensis*  
*Ficus semicordata*  
*Ficus tinctoria*  
*Garuga pinnata*  
*Gmelina arborea*  
*Hymenodictyon excelsum*  
*Melia dubia*  
*Protium serratum*  
*Schleichera oleosa*  
*Schrebera swietenoides*  
*Shorea robusta*

*Stereospermum chelonoides*  
*Symplocos cochinchinensis*  
*Syzygium cumini*  
*Terminalia tomentosa*  
*Toona ciliata*  
*Trewia nudiflora*  
*Vitex leucoxydon*

### Sub-canopy

*Bauhinia variegata*  
*Butea superba*  
*Casearia graveolens*  
*Casiarea varacca*  
*Cochlospermum religiosum*  
*Croton roxburghii*  
*Euonymus glaber*  
*Ficus auriculata*  
*Ficus palmata*  
*Gardinia turgida*  
*Homalium nepalens*  
*Litsea glutinosa*  
*Michelia champaca*  
*Miliusa velutina*  
*Streblus asper*  
*Suregada angustifolia.*

*Syzygium cerasoides*  
*Trema orientalis*  
*Wendlandia tinctoria*  
*Wrightia antidysenterica*

## Shrubs

*Bauhinia vahlii*  
*Caesalpinia bonducella*  
*Capparis spinosa*  
*Flacourtia indica*  
*Glochidion lanceolarium*  
*Glycosmis pentaphylla*  
*Ixora arborea*  
*Lawsonia inermis*  
*Securinega virosa*  
*Vangueria spinosa*  
*Woodfordia floribunda*

## Lianas/Climbers

*Asparagus racemosus*  
*Cayratia auriculata*  
*Coccinia grandis*  
*Cryptolepis buchanani*  
*Dioscorea bulbifera*  
*Entada rheedii*  
*Gnetum ula*  
*Gymnema sylvestre*  
*Hemidesmus indicus*  
*Millettia extensa*  
*Nyctanthes arbor-tristis*  
*Rivea hypocrateriformis*  
*Smilax macrophylla*  
*Ventilago denticulata*

distinct from the highland range and plateaus typified by more charnockite and gneiss and an absence of limestone and facile black shale horizons. In contrast the highland regions form one broad and complex contiguous belt of ranges, escarpments, gorges, hillocks, plateaus and ravines that are defined by higher elevations, cooler weather, more dew but relatively lower amounts of rainfall, especially on the exposed crests. The black cotton soils also have a strong influence on plant species composition, diversity, and structure, paired with the complex topography. The forest vegetation is a composite of dry deciduous and semi-evergreen forest, marshes, rocky escarpment vegetation and pockets of tropical grassland, with a characteristic dominance of sal across most of these types.

Moist-semi evergreen forests found within ravines, along the fertile river basins and in the higher elevation plains of the plateaus are the most diverse. This forest type is home to more than 80 fungi genera including mycorrhizal fungi such as *Amanita*, *Tricholoma*, *Boletus*, *Cortinarius*, *Russula*, *Gomphidius*, *Cantharellus*, *Suillus*, *Hebeloma*, *Laccaria*, *Lactarius*, *Rhizopogon*, *Scleroderma* and *Pisolithus*. Pteridophyte populations occur in specialised communities and are prominent components of the higher-elevation moist deciduous forests, with more than 96 members found with the most dominant genera, including *Asplenium*, *Nephrolepis*, *Pteris*, *Adiantum*, *Athyrium* and *Cheilanthes*. Many pteridophyte species are either shared with the eastern Himalayas or the south Eastern Ghats, but endemic species within this belt include; *Isoetes panchanana*, *Psilotum nudum*, *Ophioglossum nudicaule*, *Leptochilus lanceolatus*, *Selaginella jainii*, *Cyathea balakrishnanii*, *C. gigantea*, and *C. spinulosa*.

Mature open natural ecosystems occur between the forest stands and along higher elevation plateaus. The tropical grasslands here are biologically distinct from the savannahs prevalent throughout the Deccan and include grass species such as *Alloteropsis cimicina*, *Apluda mutica*, *Bothriochloa pertusa*, *Brachiaria ramosa*, *Cenchrus ciliaris*, *Chloris dolichostachya*, *Cynodon dactylon*, *Dichanthium annulatum*, *Rottboellia exaltata*, *Saccharum spontaneum*, *Setaria glauca*, *Sorghum halepense*, *Sporobolus diander*, *Themeda quadrivalvis*, *Vetiveria zizanioides*, *Digitaria* spp., *Echinochloa* spp., *Eragrostis* spp., and *Panicum* spp.. Additionally herbs and grasses may be found along forest borders, escarpments and embankments, such as *Anisomeles indica*, *Cassia tora*, *Heteropogon contortus*, *Hyptis suaveolens*, *Iseilema laxum*, *Leonotis nepetaefolia*, *Tephrosia purpurea*, *Themeda quadrivalvis*.



Dry deciduous forest species shared with surrounding ecoregions are not widespread, being mainly found along exposed, eroded ridges or more nutrient-depleted soils, including species such as *Anogeissus latifolia*, *Bauhinia purpurea*, *Bombax ceiba*, *Bridelia retusa*, *Buchanania lanzan*, *Butea monosperma*, *Careya arborea*, *Cassia fistula*, *Cassine glauca*, *Cordia dichotoma*, and *Dalbergia paniculata*. Other more moisture-dependent species are: *Ficus tinctoria*, *Toona ciliata*, *Dillenia pentagyna*, *Schleichera oleosa*, *Protium serratum*, *Croton roxburghii*, *Bauhinia variegata*, and *Litsea glutinosa*.

## **Plant seasonality**

Annual cycles of leaf flush and fruiting of semi-evergreen and evergreen species usually show a single peak. However flowering seems concentrated in both summer and winter, with major species variation in flowering duration and convergence. Additionally, the nearly 15 *Ficus* species follow asynchronous reproductive cycles with fruiting distributed throughout the year. The table on the following page attempts to indicate main periodicity of phenophases, which may be present in smaller numbers through the year.

















## **Pollination and seed dispersal ecology**

Most flowers are generalist in nature with multiple fauna pollinating and visiting several different species. Moist deciduous forest trees produce copious amounts of nectar and thus are mainly pollinated by birds and hymenopterans, and less often by other insect orders. Of the trees, two thirds of the fruits are dispersed by wind, largely dictated by the dominant presence of large populations of the dipterocarp *Shorea robusta*, while select other dominant species are dispersed by a combination of water and wind. Most other species are animal dispersed and frugivore-dependent. Fruits are predominantly dispersed by birds, primates, large mammals, and bats.

## **Animal life**

The vast ranges and tracts of forest are crucial in sustaining large mammal populations including the Tiger, Asian Elephant, Sloth Bear, Indian Leopard and several ungulate species including the Barasingha, Nilgai, Chinkara, and Gaur. The corridors and buffer zones encapsulating the protected areas are crucial for the mobility and sustenance of healthy and viable populations of these mammals. These forests hold a rich and diverse community of more than 240 species of birds. The diversity of habitats and

# Plant seasonality

J	F	M	A	M	J	J	A	S	O	N	D
											
											
											

species associations results in birds occupying a variety of important niches in this ecosystem. Moist forest bird species with important extensions of distribution within this ecoregion include: Malabar Pied-Hornbill, Streak-throated Woodpecker, White-rumped Needletail, Crested Treeswift, and Malabar Whistlingthrush. More than 30 species of reptiles are found, while amphibian diversity is somewhat limited compared to the Western Ghats and Eastern Himalaya. The insect populations of these forests are largely seasonal, occurring in high numbers during the monsoon months and decreasing during the drier months. Insect diversity is closely associated with the structural maturity and diversity of forest tracts.

## Conservation

Much of the existing forest ranges and protected areas are home to many villages and populations that still rely heavily on resources from these forests including fuel wood, honey, sap, and timber, besides grazing grounds for their livestock. Additionally, on a landscape level, parts of the buffer zone forests have been lost or altered due to agrarian expansion or shifting cultivation. Expansion of mining, which in many areas are situated within core areas of larger forest tracts, continues to have severe detrimental effects. Nearly 11% of the existing forests are lost annually, much of it due to external developmental pressures.

Fortunately for conservation, many protected areas within the ecoregion are large (>2000 km<sup>2</sup>) and well-connected with corridors and buffer zones, but these remain under threat. Disturbances have led to functionally and structurally changed forests with more scrubland and dry deciduous species and drastic multifold increase in annual forest fires over the last 50 years. Long-term studies indicate the East Deccan Moist Deciduous Forests have suffered a significant decline in annual rainfall and an increase



Left to right: Bengal tiger, barasingha, Malabar pied hornbill, sloth bear

in average temperature exacerbating the human land use effects. Conservation of the highland ecosystems of the east Deccan are crucial for many of the larger river systems and the sustenance of millions who directly or indirectly rely on these forests. Additionally, these ranges contain some of the last large scale- contiguous forest tracts left in India.

## **Important Protected Areas in the Ecoregion**

Similipal Biosphere Reserve  
Amarkantak Wildlife Sanctuary  
Kanha Tiger Reserve  
Indravati National Park  
Kanger Ghati National Park  
Karlapat Wildlife Sanctuary  
Kambalakonda Wildlife Sanctuary  
Satpura National Park  
Pench National Park  
Tikarpada Wildlife Sanctuary  
Satkosia Tiger Reserve  
Dasapalla Elephant Reserve  
Kalahandi Range  
Khandapada Reserve Forest  
Deogarh Reserve Forest  
Bamra Gangpur Reserve Forest  
Saranda-Singhbhum Reserve Forest  
Chilpi Reserve Forest.

## **Ecological Restoration Projects in the Ecoregion**

We are currently not aware of any projects located in this ecoregion. Please mail us on [hello@era-india.org](mailto:hello@era-india.org) if you know of any projects that could be listed here.

# Acknowledgements

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[cover] Ecoregion Map: Madhavan A.P.

[Pg 1] Burki Sada, Satpura: A.J.T Johnsingh

[Pg 3] *Shorea robusta*: Aniruddha Singhamahapatra

[Pg 3] *Crateva religiosa*: Rison thumboor

[Pg 3] *Schrebera swietenoides*: A.J.T Johnsingh

[Pg 3] *Hymenodictyon excelsum*: Dinesh Valke

[Pg 3] *Casearia graveolens*: Dinesh Valke

[Pg 3] *Ficus palmata*: Dinesh Valke

[Pg 3] *Gardenia turgida*: A.J.T Johnsingh

[Pg 3] *Trema orientalis*: Vinayaraj

[Pg 3] *Caesalpinia bonducella*: Vinayaraj

[Pg 3] *Glycosmis pentaphylla*: Krzysztof Ziarnik

[Pg 3] *Capparis spinosa*: Wouter hagens

[Pg 3] *Flacourtia indica*: Vinayaraj

[Pg 3] *Cryptolepis buchanani*: Yercaud elango

[Pg 3] *Dioscorea bulbifera*: Dinesh Valke

[Pg 3] *Gnetum edule*: Dinesh Valke

[Pg 3] *Entada rheedii*: Vinayaraj

[Pg 4] Barehipani waterfall: Nihar.Race

[Pg 10] Bengal tiger: David Raju

[Pg 10] Barasingha: David Raju

[Pg 10] Malabar pied hornbill: Uday Kiran

[Pg 10] Sloth bear: Kandukuru Nagarjun

## Icons

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