

Ecoregion

# Godavari–Krishna Mangroves



**Area of the ecoregion**  
1560 km<sup>2</sup>



**Altitude**  
0 – 8 m



**Annual rainfall**  
1100 – 1800 mm



**Temperature**  
19° C – 38° C



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## Overview

The Godavari-Krishna Mangroves are an integral part of the intertidal coastal ecosystems along much of the eastern coast of the Indian Peninsula. These form larger mangrove forest tracts around the deltas of the major east-flowing river systems bridged by thin slivers of mangrove belts along mudflats and coasts. They form dense interlocked stands of specialised trees adapted to recurring inundation, high salinity, and the dynamic coast – ocean interface. It provides habitat for nursing young fish and larvae and are highly productive ecosystems with unique estuarine vertebrates and invertebrates. The mangroves crucially shield the structural integrity of the eastern shoreline against extreme climate events and large-scale erosion. For all their ecological and social value, mangrove ecosystems are little known and are threatened by anthropogenic pressures like urbanisation, industrial intrusion, farming, and pollution.

## Adjoining ecoregions

This ecoregion shares the coast with several of the eastern peninsular ecoregions including the Deccan Thorn Scrub Forests, East Deccan Dry Evergreen Forests, Central Deccan Plateau Dry Deciduous Forests, East Deccan Moist Deciduous Forests and the Orissa Semi-Evergreen Forests.



Mangrove forests meeting a tidal pool, Bhitarkanika national park

## Geography

The ecoregion extends along 1560 km of the east coast with broader mangrove forest belts accounting for about 40% of the range and spans 7020 km<sup>2</sup> as clustered mangrove complexes along suitable sediment and tidal zones. The mangrove forests of this region are found primarily situated in the intertidal estuarine zones of the major river deltas on the east coast including the Brahmani and Mahanadi river delta complex in Orissa. Extending in longer belts along Godavari river delta, Krishna river delta, and Pulicat lake island ecosystems in Andhra Pradesh and Telangana. And extending down through the Kaveri river delta till the salt flats of Point Calimere in Tamil Nadu. The region is mostly located along the mean sea level with a maximum of 1.5 m elevation in the intertidal coastal zones.

## Geology and Soil

The eastern coast of the peninsula is distinguished by a gentle terrestrial gradient and high amounts of sediment output by large fluvial river systems travelling through the interior of the Deccan. Mangroves are usually present in the sites of exchange of fresh and salt water in clay rich, fine-silted anaerobic and waterlogged soils. The soils have high nutrient availability of nitrogen, phosphorus, and potassium paired with large amounts of silicate. Mangrove soils have large concentrations of sodium chloride and other oceanic salt substrates. The soil of this forest type has no structural integrity and are largely free floating depository particles that expand and gain volume through an emulsion of salt and freshwater. Without repeated and complete submersion every six hours the soil systems will become hardened, compacted and impenetrable, becoming largely inhospitable for plants and other intertidal organisms. The biotic component of the soil includes filter feeders like molluscs, crabs, worms, mudskippers, sand hoppers, and sand eels, which aerate the substrate and help prevent complete rot due to the lack of oxygen. The mangrove root network plays a vital structural role in holding these sediment beds from being washed away by repeated wave action without which most large sediment stands would undergo rapid erosion.

## Climate

This ecoregion has a typical humid tropical coastal climate, with intense summers reaching temperatures of 38°C to mild winters with a minimum of 19°C. Monsoonal rains are received through the southwest monsoon from July to September and more significantly the northeast monsoon from October to December. This ecoregion



Trees[left to right]: *Avicennia marina*, *Avicennia officinalis*, *Excoecaria agallocha*, *Rhizophora apiculata*



Trees[left to right]: *Acanthus ilicifolius*, *Sonneratia apetala*, *Aegiceras corniculatum*, *Bruguiera cylindrica*



Godavari and krishna delta

receives an average annual rainfall of 1100 to 1800 mm. The monsoons play a very limited role in the hydrological input into the ecosystem which is largely fed by oceanic and river processes. However the seasonality and direction of prevailing trade winds, depressions and velocity influence wave energy dynamics (constructive, or destructive), large scale ocean current directions, temperature, and microclimate. The coastline is a dynamic and high energy kinetic ecosystem with coastal boundaries constantly moving and shifting moving millions of tonnes of sand and sediment north and south every year along with prevailing wind and wave action direction. During the southwest monsoon, winds travel northward and thus waves transport gigantic amounts of sand up north, the cycle is then reversed during the northeast monsoon, when sediment is transported back southwards. As the southwest trade winds are of longer duration, there is a net transport of sediment northwards along the coast, with a clear seasonality. During the northeast monsoon, the coastline typically receives large-scale cyclones and depressions, coming with extremes of wind speed, and large 'storm surges'.

## Natural vegetation

Mangrove forests are highly productive ecosystems. Mangrove trees are broad

statured, predominantly evergreen and form a dense interlocked canopy and roots along estuaries, back waters, creeks, lagoons, marshes, swamps, and mudflats. The true mangrove plants and halophytes that thrive in this ecosystem have several adaptations specific to tidal environments; such as being able to survive in oxygen-deprived soils, in high levels of salinity, and withstand strong wave action. Physical adaptations include stilt and knee roots that emerge above ground (up to 1 m) and aid in structural support against strong wave action and waterlogged conditions besides helping with aeration. Most mangrove species have subsurface root systems with dense interlocked networks on the upper surface of the soil. True mangrove species grow pneumatophores or upward-pointing roots that emerge above the surface for gaseous exchange. Mangrove plants actively maintain osmotic potentials between their tissues and the concentrated saline water, expelling excess salts through glands on the underside of the leaves. About 35 mangrove species are found within this ecoregion with different deltas having subsets of the regional pool. Some lianas and shrubs occur as mangrove associates but are found in drier less tidal areas; their presence is variable but adds more structural and ecological complexity to this forest type.

## Characteristic native plant species

These selection of trees are the species common to the northern and southern latitudinal zonations.

### Key species

*Acanthus ilicifolius*

*Acrostichum aureum*

*Aegiceras corniculatum*

*Avicennia marina*

*Avicennia officinalis*

*Bruguiera cylindrica*

*Ceriops decandra*

*Ceriops tagal*

*Excoecaria agallocha*

*Heritiera littoralis*

*Lumnitzera racemosa*

*Rhizophora apiculata*

*Rhizophora mucronata*

*Sonneratia apetala*

*Xylocarpus granatum*

*Xylocarpus moluccensis*

There are significant differences in floristic community and stand structure between the northern delta tracts and southern mangrove belts. The northern extents (above the

# Characteristic native plant species

## True Mangrove Species

*Acanthus ilicifolius*  
*Acrostichum aureum*  
*Aegiceras corniculatum*  
*Avicennia marina*  
*Avicennia officinalis*  
*Bruguiera cylindrica*  
*Ceriops decandra*  
*Ceriops tagal*  
*Excoecaria agallocha*  
*Heritiera littoralis*  
*Lumnitzera racemosa*  
*Rhizophora apiculata*  
*Rhizophora mucronata*  
*Sonneratia apetala*  
*Xylocarpus granatum*  
*Xylocarpus moluccensis*













## Northern Species

*Aegialitis rotundifolia*  
*Brownlowia tersa*  
*Bruguiera gymnorhiza*  
*Kandelia candel*  
*Scyphiphora hydrophylacea*  
*Sonneratia alba*  
*Naringi crenulata*  
*Ochna obtusata*  
*Phyllanthus polyphyllus*  
*Pterolobium hexapetalum*  
*Walsura trifoliata*  
*Wendlandia tinctoria*  
*Ziziphus mauritiana*

## Southern Species

*Pemphis acidula*  
*Rhizophora lamarckii*  
*Rhizophora annamalayana*

# Plant seasonality

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



Krishna delta) have a higher species diversity. Mangrove belts near Pichavaram may have as few as 12 species whereas the Godavari delta has 24 species.

## Variation within ecoregion

There are significant differences in floristic community and stand structure between the northern delta tracts and southern mangrove belts. The northern extents (above the Krishna delta) have a higher species diversity. Mangrove belts near Pichavaram may have as few as 12 species whereas the Godavari delta has 24 species.

Species limited to the northern tracts	Species more typical in the south
<i>Aegialitis rotundifolia</i>	<i>Pemphis acidula</i>
<i>Brownlowia tersa</i>	<i>Rhizophora lamarckii</i>
<i>Bruguiera gymnorrhiza</i>	<i>Rhizophora annamalayana</i>
<i>Kandelia candel</i>	
<i>Scyphiphora hydrophyllacea</i>	
<i>Sonneratia alba</i>	



Left to right: Asian water monitor lizard, mudskipper



Left to right: Fishing cat, black-capped kingfisher

Salinity, a crucial variable determining the zonation of mangrove types, may itself be a product of large-scale geographic, anthropogenic, and ecological processes. Higher salinity levels can be detrimental to the functional growth, health, reproductive capacity and diversity of mangrove stands. In turn salinity levels are greatly influenced by landscape-level processes, reducing with the volume of freshwater arriving at estuarine mouths. Higher river outflow also brings higher sediment input into these intertidal zones, which supports ecosystem health and diversity.

On a larger scale, northern mangrove tracts share more commonality with the Sundarbans and Andaman & Nicobar islands, while southern mangrove types are more harsh in environmental conditions, hold less sediment, have lower freshwater input levels and share more similarity with the Lakshadweep complex.

## **Plant seasonality**

Flowering commences during the summer and pre-monsoon period, while fruiting begins after the monsoonal rains. There is significant variation in duration and timing between species. Furthermore, mangrove species are sensitive to microclimate and influenced by annual climatic variability.

## **Pollination and seed dispersal ecology**

Most flowers of mangrove species have adapted to an explosive pollination method that allows flowers to interact and exchange pollen with insects and via the means of wind. Insect pollination is mainly due by bees and wasps, including trigonid bees, besides other small insects. A majority of the true mangrove species are unisexual with separate male and female tree individuals. There are twice as many male trees compared to female trees and 16 times as many male flowers, aiding in wind pollination when insect densities are scarce or absent. Wind pollination in mangrove trees functions as a fail-proof strategy when more targeted nectar-based pollination fails due to harsh and uncertain environmental conditions. This strategy is consolidated by most species having the capacity to self pollinate.

A distinctive adaptation of true mangrove species is vivipary (as in *Rhizophora apiculata*, *R. mucronata* and *Bruguiera gymnorrhiza*) and crypto-vivipary (*Excoecaria agallocha*, *Sonneratia apetala*) methods of seedling dispersal. In vivipary, the seeds germinate while still attached to the mother tree and fall to the ground as germinated

shoots. About 16 percent of the fruits attain maturity in this method with seed predation accounting for a quarter of mature seed loss in the vivipary process. Seeds have no dormancy period and are primarily distributed by mechanical means such as tidal action or by simply falling and establishing themselves beneath the parent trees.

## **Animal life**

Mangrove forest habitats play a crucial role as spawning ground and nurseries for juvenile fishes and fish larvae of both oceanic and estuarine species due to the protective nature of the labyrinth-like root system and dense growth. Thus mangrove forest habitats are some of the most biodiverse and dense hotspots pockets for oceanic and estuarine vertebrate and invertebrate species including hundreds of species of crab, fishes, shellfish, molluscs, insect larvae, mudskippers, and eels. Some examples include fiddler crabs, sand eels, and the banded arc fish. Mammal species that inhabit these forests include the golden jackal, smooth-coated otter, and the fishing cat. Characteristic larger reptiles and semi-terrestrial species include the water monitor lizards and the saltwater crocodile in select locations. The coastlines are crucial nesting sites for olive ridley turtles, a keystone species.

Large populations of more than 140 species of birds also occur, including flamingoes, avocets, pelicans, plovers, curlews, storks, and sandpipers. Other characteristic birds include the black-capped kingfisher and the white-bellied sea eagle. At least 63 fungi species have also been recorded, with some like *Keissleriella blepharospora*, *Mycosphaerella pneumatophorae*, and *Rhabdospora avicenniae* associated exclusively with mangrove trees.

## **Conservation**

Mangrove forest tracts play an imperative role in the future, sustenance, and health of coastal zones and global fish populations. Dense, mature mangrove tracts act as natural barriers against large cyclonic storms or tsunamis and reduce coastal erosion which has become more of a concern with increasing alteration of sediment cycling processes and shoreline dynamics. Mangrove forest and associated tidal habitats account for more than 80% of coastal fisheries. Thus the protection, recognition and restoration of mangrove habitats are vital. Most of these mangrove tracts are outside demarcated protected areas, making them vulnerable to misuse and disturbance. Most of the Godavari-Krishna mangrove habitats face drastic encroachment from aquaculture factories such as shrimp producers, agricultural land expansion, and coastal development intrusions (harbours, urban development). Large-scale dam projects along the major east flowing rivers of the southern

peninsula also affect mangrove forest health (by curtailing sediment and freshwater inputs). Mangrove nurseries have played a role in actively restoring marshes, tidal flats and lagoons with key species, principally *Avicennia marina* and *A. officinalis*, the two most dominant species of the Godavari-Krishna Mangrove ecoregion. Planting out nursery-raised seedlings has shown better results than natural regeneration in highly degraded areas affected by acidification and aridification of intertidal, estuarine and delta habitats.

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

Bhitarkanika National Park

Coringa Wildlife Sanctuary

Pulicat Lake Bird Sanctuary

Point Calimere Wildlife and Bird Sanctuary

Kharinasi Reserve Forest

Kilo Reserve Forest

Suniti Reserve Forest

Bhairavapalem reserve Forest

Rathikalava Reserve Forest

Masanitippa Reserve Forest

Matlatippa Reserve Forest

Balusu Tippa Reserve Forest

Kothapalem Reserve Forest

Kandikuppa reserve forest

Sorlagondi Reserve Forest

Nachugunta Reserve Forest

Yelichetlidibba Reserve Forest

Lankavanidibba Reserve Forest

Mulagunta Reserve Forest

Kothapalem Reserve Forest No: 1 & No: 2

Adavuladeevi Reserve Forest

Pichavaram Mangrove 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] Mangrove forests meeting a tidal pool, Bhitarkanika national park: Puru150

[Pg 3] *Avicennia marina*

[Pg 3] *Avicennia officinalis*

[Pg 3] *Excoecaria agallocha*

[Pg 3] *Rhizophora apiculata*

[Pg 3] *Acanthus ilicifolius*

[Pg 3] *Sonneratia apetala*

[Pg 3] *Aegiceras corniculatum*

[Pg 3] *Bruguiera cylindrica*

[Pg 4] Godavari and krishna delta: Public domain

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One Earth Ecoregion Snapshot  
<https://www.oneearth.org/ecoregions/godavari-krishna-mangroves/>



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