

MANGROVES

Mangroves are various types of trees up to medium height and shrubs that grow in saline coastal sediment habitats in the tropics and subtropics

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A photograph of a mangrove forest with a narrow waterway. The trees are lush green, and their roots are visible in the water. The sky is overcast.

MANGROVE DISTRIBUTION

MANGROVE DISTRIBUTION

Mangrove refers to a variety of trees and shrubs belonging to some 12 genera and up to 60 species of flowering plants and trees.

They are adapted in the most unique ways to live along tropical and subtropical shores around the world.

They are essentially land plants that can tolerate salt.

Luxuriant and very productive mangrove forests flourish along muddy or sandy shores protected from waves.



MANGROVE DISTRIBUTION

Mangroves occurring in 112 countries and territories.

According to various workers, mangrove global coverage are 10 million hectares (Bunt, 1992).

14-15 million hectares (Schwamborn and Saint Paul, 1996).

24 million hectares (Twilley et al., 1992).

18 million hectares (Spalding, 1997).

41.4 % in South and Southeast Asia and additional 23.5% in Indonesia.



MANGROVE DISTRIBUTION

Region	Area (Sq. km)	Percent
South & Southeast Asia	75,170	41.4
America	49,096	27.1
West Africa	27,995	15.4
Australia	18,788	10.4
East Africa & Middle East	10,348	5.7

MANGROVE DISTRIBUTION

Mangroves are occurring limited in Japan, Bermuda, New Zealand, Australia and east coasts of South Africa (Spalding, 1997; Yang et al., 1997).

No mangroves in Hawaiian islands, since the early 1900's . Latter 6 species have been introduced.

The red mangrove (*Rhizophora mangle*) is the most common species in southern Florida, Caribbean and the Gulfs of California and Mexico.

Other species of *Rhizophora* found common on tropical coasts.

The black mangrove, *Avicennia germinans* and white mangrove, *Laguncularia racemosa* are found along the Caribbean and Atlantic coasts.



MANGROVE DISTRIBUTION

Most of the species of mangroves are found along the shores of **Western Pacific and Indian Oceans.**

There are two main centres of mangroves: the **Eastern hemisphere and Western hemisphere.**

The Eastern hemisphere is **Indo-Malesia and Australia.**

The Western hemisphere is **Atlantic East pacific region that includes West America, East America and West Africa.**



MANGROVE DISTRIBUTION

The Eastern Africa is considered as a place of origin for mangroves with 49 species and hence the region is called as the “Old World Mangroves.

The Western hemisphere as the “New World Mangroves” with 11 no. of species (Duke, 1992).

The genera like *Peliciara*, *Conocarpus* and *Laguncularia* are present only in the new world whereas *Osbornia* and *Camptostemon* exist only in the old world.



MANGROVE DISTRIBUTION

<i>Country</i>	<i>Mangroves (1000 ha.)</i>	<i>Global %</i>
Indonesia	4250	30
Brazil	1376	10
Australia	1150	8
Nigeria	970	7
Malaysia	641	5
Bangladesh	611	4
Myanmar	570	4
Vietnam	540	4
Cuba	530	4
Mexico	525	4
Senegal	440	3
India	360	3
Colombia	358	3
Cameroon	350	2
Madagascar	327	2

MANGROVE DISTRIBUTION

Past and present extent of distribution, damage and reclamation caused in the recent past.

Mangrove forest continues to disappear all over the world. They are destroyed by man-made pressures and environmental stress factors.

Global loss rates annually at one million ha, with some regions in dangers of complete collapse (Kathiresan & Bingham, 2001).



MANGROVE DISTRIBUTION

Country	Period of record	Estimated original mangrove area	Estimated present mangrove area	Percentage
Cuba	1969-1989	476000	448000	94
Bangladesh	1963-1990	685000	587000	86
Guatemala	1965-1978	58000	50000	86
Malaysia	1979-1986	113000	89000	79
Ecuador	1966-1989	235000	177500	76
Thailand	1961-1993	300000	219200	73
Vietnam	1969-1990	425000	286400	67
U.S.A	1958-1983	260000	175000	67
Colombia	1976-1989	480000	307000	64
Indonesia	1969-1986	4220000	2176000	52
Philippines	1968-1995	448000	140000	31
Singapore	1922-1989	700	180	26
Puerto Rico	1930-1985	26300	3000	11
South India (Kerala)	1911-1989	70000	250	4

ADAPTATIONS

The image shows a dense mangrove forest with a narrow, calm waterway in the foreground. The water reflects the surrounding green foliage and the sky. The trees have thick, tangled roots visible in the water. The word 'ADAPTATIONS' is superimposed in the center of the image in a large, bold, 3D font. The letters are blue on top and red on the bottom, with a black shadow effect.

ADAPTATIONS



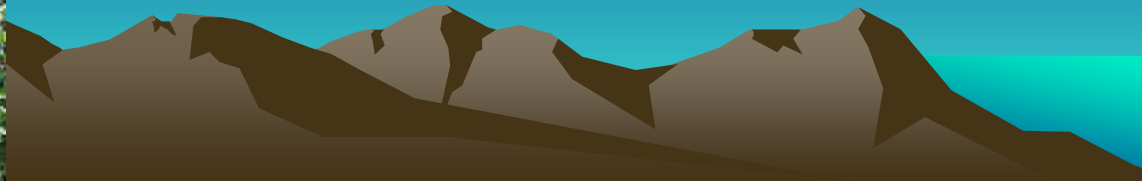
They are salt tolerant.

They have aerial and shallow roots.

Mangroves have special physiological adaptations to prevent salt from entering their tissues.

Mangroves excrete excess salt.

Many mangroves are viviparous.



ECOLOGICAL FEATURES

A photograph of a mangrove forest with a narrow waterway. The trees are lush green, and their roots are visible in the water. The text 'ECOLOGICAL FEATURES' is overlaid in large, 3D, orange-yellow letters.

Ecological Features

Acanthus ilicifolius

- Shrub up to 2m tall growing along tidal swamps.
- Ariel roots-stilt root
- Leaves simple, opposite, lanceolate.
- Flower sessile, Fruit-capsule



Ecological Features

Aegiceras corniculatum

- Shrub growing at sheltered inter-tidal areas.
- Tolerant to high saline. Aerial roots-not prominent
- Bark smooth, reddish brown; leaves simple, alternate
- Salt glands present, Flower-white
- Fruit-cryptoviviparaous, green to reddish in maturation, smooth, sharply curved



Cryptovivipary (Greek *kryptos*, hidden) refers to the condition whereby the embryo grows to break through the seed coat but not the fruit wall before it splits open. This condition is exhibited by [*Aegiceras*](#), [*Avicennia*](#) and [*Nypa*](#) species.

Ecological Features

Avicennia alba

- Small tree growing in inter-tidal areas of riverine and estuarine mangrove swamps, dry areas, tolerant of high salinity
- Aerial roots-pencil like pneumatophores, spongy narrowly pointed relatively slender stilt root
- Leaves-simple, opposite
- Fruit-pericarp (the part of a fruit formed from the wall of the ripened ovary), yellowish green



Ecological Features

Avicennia marina

This species can be distinguished from other *Avicennia* by its elliptic oblong or elliptic ovate leaves and very short-beaked, bean like fruit



Ecological Features

Avicennia officinalis

This species is recognised from other species of *Avicennia* by obovate or ovate oblong leaves and heart shaped larger fruits with wrinkled surface



Ecological Features

Excoecaria agallocha

This species can be readily distinguished in the field by its light green and reddish leaves with wavy margin, catkin like male inflorescence and poisonous milky latex



Ecological Features

Ceriops tagal

- Tree/shrub growing at intertidal estuarine banks and or dry and high saline areas
- Aerial roots, leaves-simple, opposite, obovate, rounded leaf tip
- Fruit-viviparous, green to brown



Ecological Features

Ceriops decandra

This species easily distinguished from *C.tagal* by its shrubby nature, petals fringed with many ciliae



Ecological Features

Bruguiera cylindrica

- Tree/shrub growing along creeks or inner mangroves zone; Aerial roots-oval shaped, knee roots
- Leaves-simple, opposite
narrowly elliptical
- Flower-small , Fruit viviparous



Ecological Features

Kandelia candel

Linear-oblong, reflexed
calyx-lobes, numerous
stamens and the long,
smooth, spindle-shaped
hypocotyls



Ecological Features

Nypa fruiticans

- Palm growing in low saline, sheltered inter-tidal creeks and channels in the mangrove forests
- Aerial roots-no prominent aerial roots
- Leaves-lanceolate, palm leaf, arising from root stock, yellow when young
- Flower-female in globose head, male in catkin like
- Fruit-dark brown or brick red



Ecological Features

Rhizophora annamalayana

- Tree growing in soft mud along the inter-tidal creeks & channels.
- Aerial roots-extensively developed stilt root
- Leaves-simple, opposite, broadly obovate, darkish green
- Flower-few flowered creamy white
- Fruit-rough surface, viviparous hypocotyls



Ecological Features

Rhizophora apiculata

Dark green narrowly elliptical acute leaf-tip, 2 flowered inflorescence, 12 brown stamens of flowers and the formation of hypocotyl in axils of leafles old branches



Ecological Features

Rhizophora mucronata

Light green, broadly elliptical leaf with mucronate tip, Axillary cymes with more than two flowers, hairy petals and 8 stamens



Ecological Features

Xylocarpus granatum

- Tree growing in sheltered, low saline inter-tidal river banks, Aerial roots-buttresses and plank
- Leaves-compound, alternate, tip rounded
- Fruit-Yellowish brown, ball shaped



Mangroves



Acanthus ebracteatus



Acanthus ilicifolius



Aegiceras corniculatum



Aegialitis rotundifolia

Mangroves



Avicennia alba



Avicennia marina



Avicennia marina var. *acutissima*



Avicennia officinalis

Mangroves



Heritiera littoralis



Heritiera fomes



Excoecaria agallocha



Ceriops tagal

Mangroves



Ceriops decandra



Bruguiera sexangula



Bruguiera gymnorhiza



Bruguiera cylindrica

Mangroves



Kandelia candel



Lumnitzera littorea



Lumnitzera racemosa



Nypa fruiticans

Mangroves



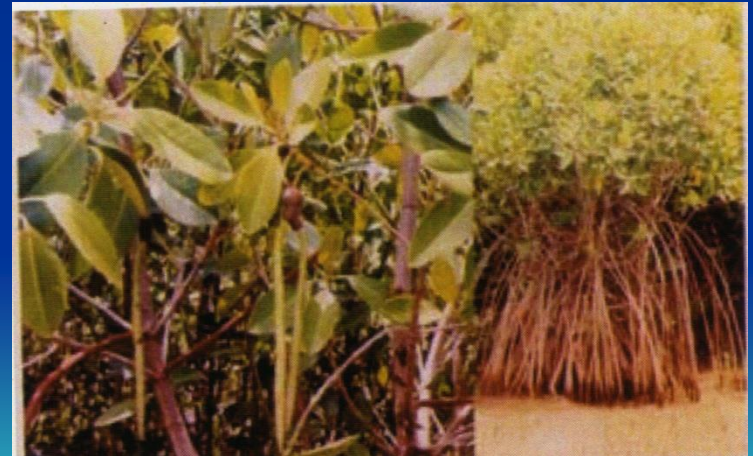
Pemphis acidula



Rhizophora annamalayana



Rhizophora apiculata



Rhizophora mucronata

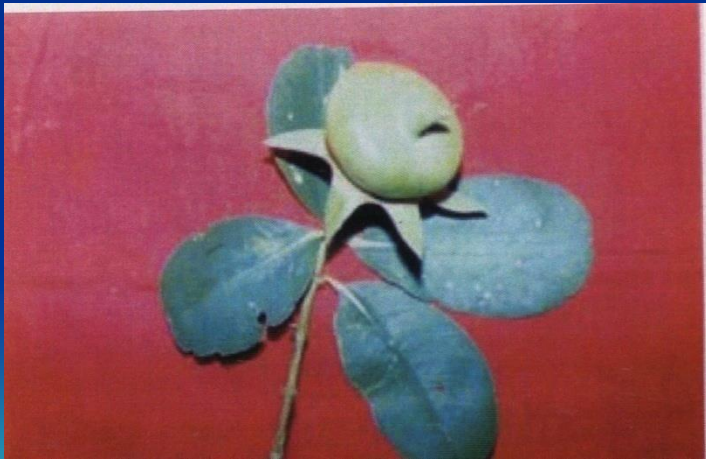
Mangroves



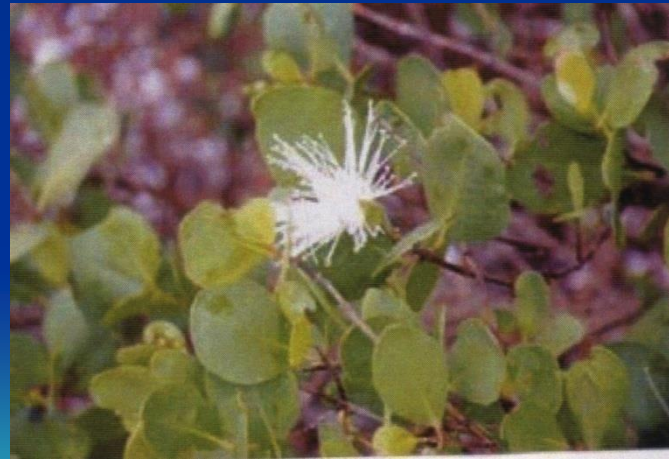
Acrostichum aureum



Xylocarpus granatum



Sonneratia caseolaris



Sonneratia alba

Mangroves

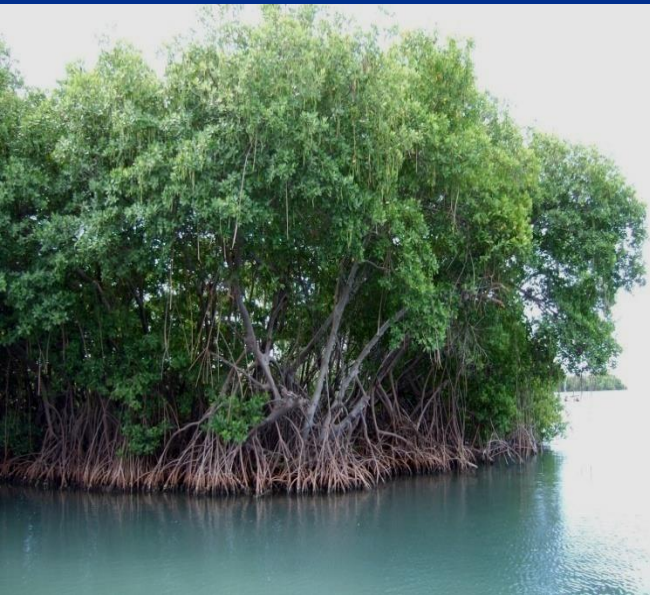


Sonneratia apetala



Fruit of *Rhizophora*

MANGROVES



Total Area	6,740 Sq km.
Species Recorded	39
Associated Flora	420
Associated Fauna	1862
East Coast	57%
West coast	23%
Andaman & Nicobar Islands	20%



SOURCE OF OXYGEN



Mangroves act as a CO₂ sink



**High carbon sequestration
About 1.5 ton per ha**

MANGROVES ENHANCING FISHERY RESOURCES

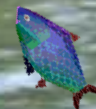
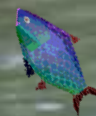
Fish resources increased

Globally > 80% of marine catches

90% of marine organisms spend part of life cycle

Mangroves provide an attachment site for gastropods, bivalves, sponges and anemones.

Trees themselves provide nesting site for many birds.



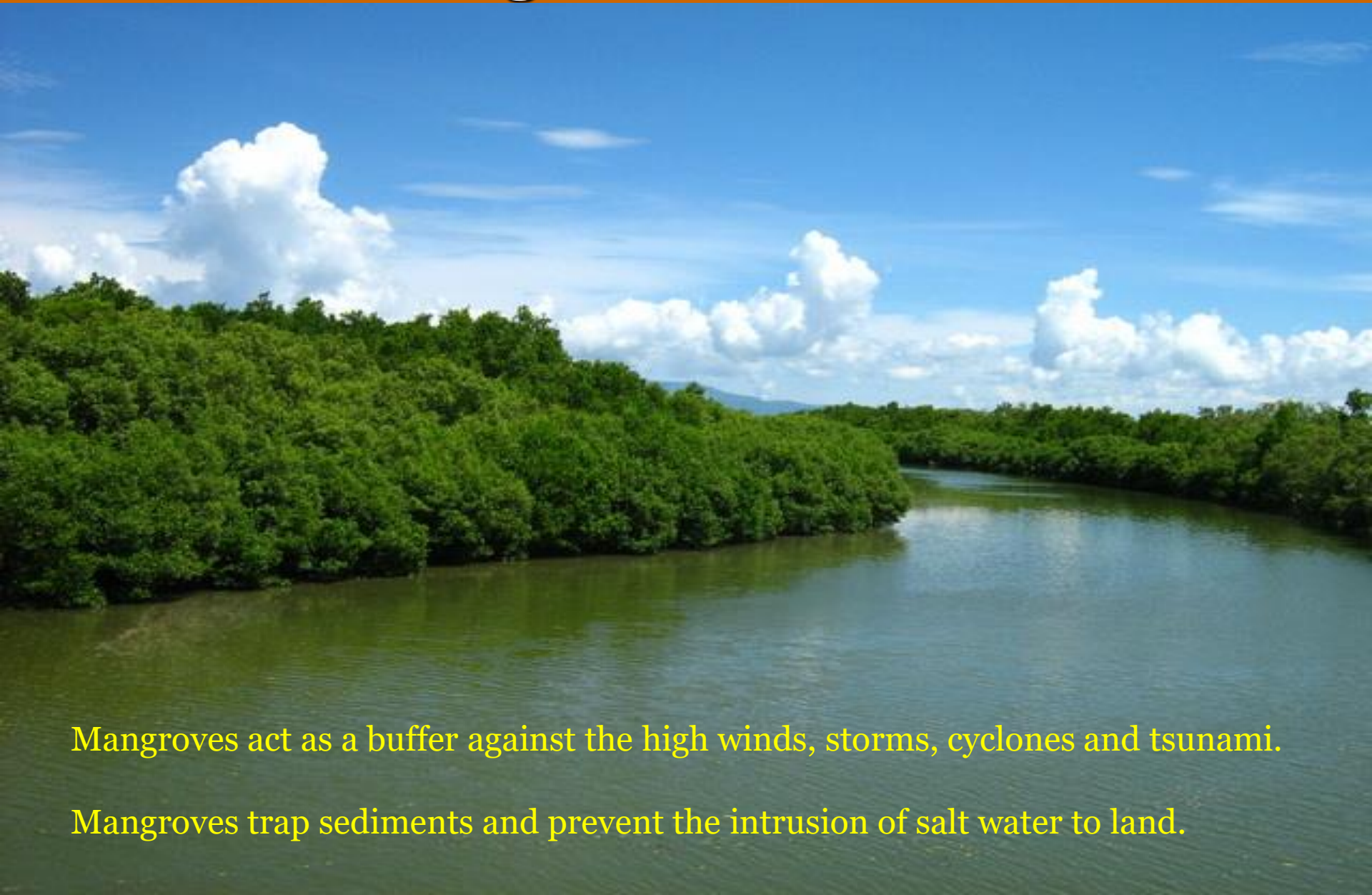


Fishers income 70 times greater in mangrove-rich areas than mangrove-poor area

Sea turtles Nesting



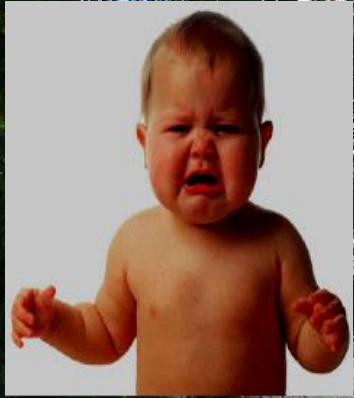
Mangroves are Buffer



Mangroves act as a buffer against the high winds, storms, cyclones and tsunami.

Mangroves trap sediments and prevent the intrusion of salt water to land.

Tsunami of December 26, 2004



Tsunami just opposite to CAS Marine Biology



Concrete Boat Jetty

Concrete structures broken into pieces, but not mangroves



SOURCE OF INDUSTRIAL PRODUCTS



A wide range of industrial materials like timber, honey,, firewood, industrial enzymes were derived from mangroves

USES OF MANGROVES

Uses	Functions	Attributes
Forestry	Flood mitigation	Biological diversity value
Agriculture	Prevention of intrusion of saline waters	Socio-economic values
Salt production	Storm protection	Cultural Value
Food, drugs, beverages	Sediment trapping	Historic value
Fuel wood, charcoal	Toxicant removal	Aesthetic value
Fishing/aquaculture materials	Groundwater recharge	Wilderness value
Household items	Erosion control	Educational value
Textile and leather production	Nutrient export	Research value
Agriculture	Wildlife habitat	
Construction materials	Fish/shellfish habitats	
Water supply	Protection of offshore habitats	
Wildlife protection	(coral reefs, sea-grass beds)	
Recreation/tourism		
Research site		
Education site		
Transport routes		

CAUSES OF MANGROVE DEGRADATION

Natural induced changes.

Diseases.

Man made activities

Urbanization

Agriculture

Aquaculture practice

Cutting for timber, fuel and charcoal.

Prevention of freshwater flow and tidal flow.

Oil pollution

Pollution issues

War problems

Mining operations.

