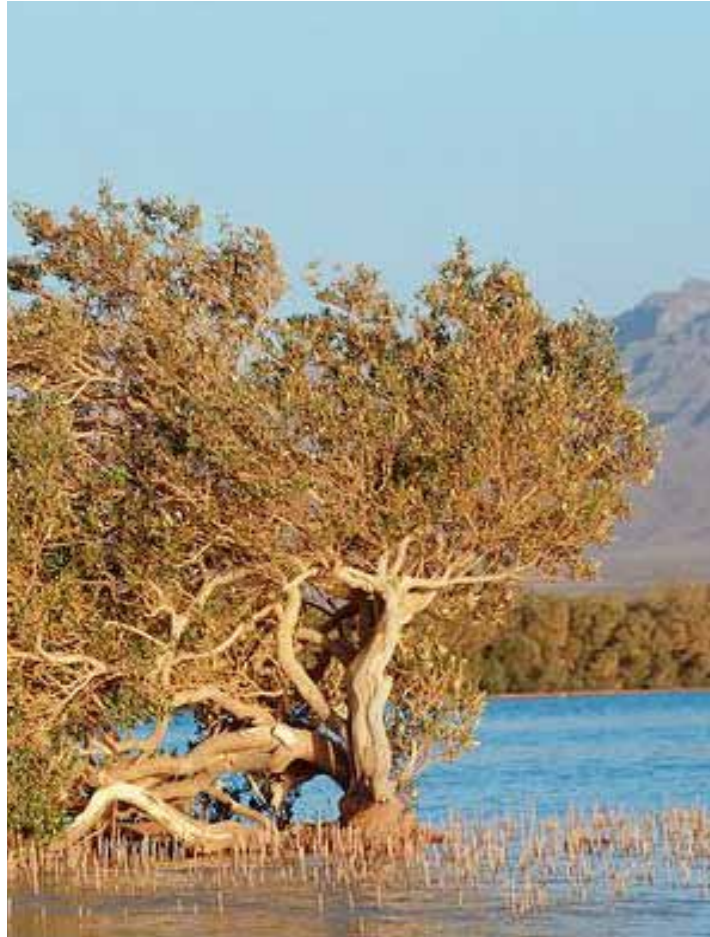


ENVIRONMENTAL ATLAS OF ABU DHABI EMIRATE

Roots & shoots

A teacher briefing on mangrove forests

This teacher briefing is for teachers and other educators to give young people an understanding of mangrove forests.



Mangroves in Abu Dhabi

At the intersection of land and sea, mangrove forests support a wealth of life.

Mangroves are forests of salt-tolerant trees that grow in the shallow tidal waters of some coastal areas of the Emirate of Abu Dhabi. They require slow water currents and plenty of fine, organic sediment in which to set their roots as well as protection from high energy waves.

The muddy waters, rich in nutrients from decaying leaves and wood, are home to sponges, worms, crustaceans, molluscs and algae, and provide shelter for marine mammals and birds.

Mangroves are essential fish nurseries and contribute to the vitality of commercial fisheries in the Emirate. The naturally occurring species of mangrove found in Abu Dhabi, locally called 'Qurm', is the grey or white mangrove, due to the colour of the underside of its leaves.

Technically, the term mangrove refers to a plant while the mangal is the plant community and habitat where mangroves thrive. The plants in the mangal can be diverse but all have special adaptations to overcome the problems of anoxia, a lack of oxygen in the continually water-logged soil; high salinity levels and frequent inundation by the tides.

While the Emirate may have scarce and limited areas of forest on land, it possesses significant mangrove forests around islands and sheltered coastal zones. While some of the mangrove stands have been recently planted, the majority are naturally occurring.

Some areas of mangrove are under varying degrees of stress, especially close to coastal developments, due to dredging, sedimentation and altered flow regimes. In Abu Dhabi, the total area of mangrove forests covers 70 km² spread along 547 km of shoreline.

Mangroves constitute a fascinating habitat interface between the terrestrial and the marine environment located in the zone between the high tide and the low tide. They act as a bridge between the ecosystems found on the land and on the sea, providing a safe haven for many organisms. They are one of the most productive and diverse wetlands on the Earth, yet these unique coastal forests are one of the most threatened habitats in the world.

Although, mangroves can be found near rivers it is most common in coastal and tidal wetlands. While these tidal swamp forests support salt tolerant vegetation as they are regularly subject to tides, they still need fresh water to grow and survive. Mangrove trees have two very special characteristics:

► Roots of mangroves are special as they not only help stabilize the tree in one of the most dynamic zones on Earth but also help take in air, water and nutrients. These trees

actually breathe through their roots.

► In most mangrove trees the seed germination occurs in the tree itself - a condition known as vivipary.

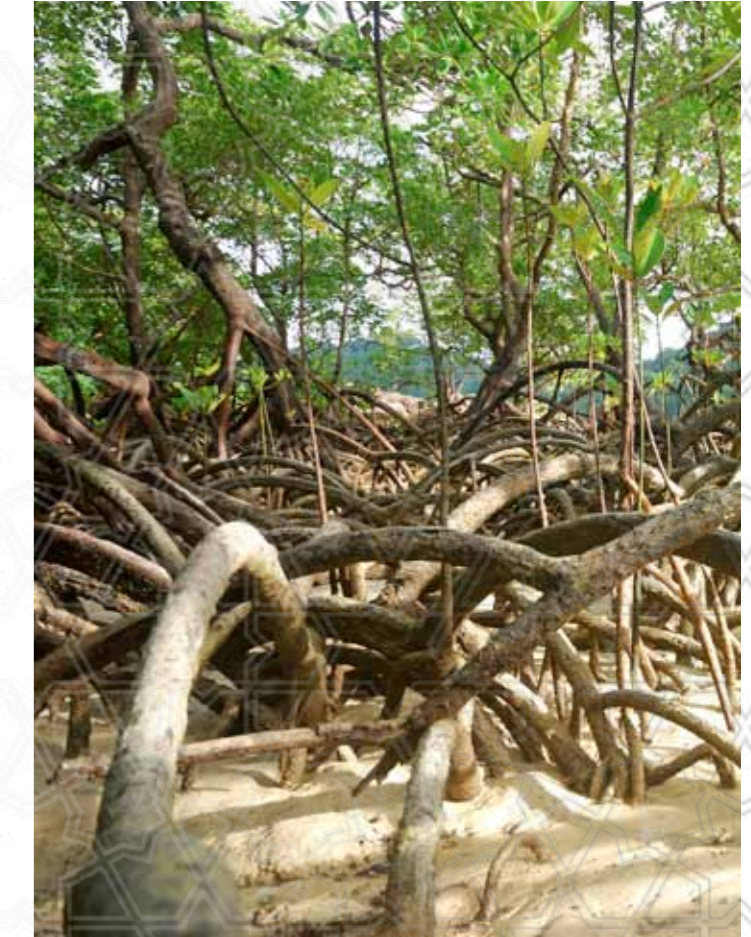
A Unique Marine Ecosystem

The mangrove forests that cover thousands of hectares of land along the UAE shoreline form an integral part of the coastal ecosystem in the UAE.

They provide a rich natural habitat and safe breeding grounds for several fish species, sea snakes, turtles and shrimp, snapper, grunt fish and sea bream.

Sea birds also find safe nesting and egg laying areas in the vast mangrove forests of the country.

Today, mangrove forests cover a wide area of the UAE, with Abu Dhabi accounting for more than 75% of the total mangrove forest area in the UAE.



Mangrove tree roots

Importance of Mangrove

Mangrove forests bring many benefits including:

- preventing the coastline erosion caused by waves and ocean currents⁽¹⁾.
- storing more planet-warming carbon dioxide than almost any other ecosystem on Earth⁽²⁾.
- supporting a complex aquatic food web and a unique habitat.
- acting as a fish nursery and being a rich source of fish, shellfish, oysters, shrimp and other crustaceans such as crabs⁽³⁾.
- being frequented by many birds, mammals and snakes who all feed on the marine resources available within the mangroves⁽⁴⁾.
- serving as rookeries or nesting areas for many species of birds⁽⁵⁾.
- protecting and stabilizing low lying coastal lands against strong wave action, winds and floods⁽⁶⁾.
- mangrove wood is used for construction, firewood and charcoal.
- mangrove leaves provide fodder for livestock such as camels.
- Mangrove trees act as a sink absorbing pollutants from sewage and water wastes.
- Honey is produced from mangrove flowers.

➤ providing excellent opportunities for eco tourism⁽⁷⁾.

Threats to the Mangroves

Man Made threats to mangroves include:

- reclaiming mangrove areas - coastal development, dredging and land filling activities⁽⁸⁾.
- being used for commercial production of food - fish and shrimp⁽⁹⁾.
- dumping wastes - using Mangroves as dump sites⁽¹⁰⁾.
- over logging - timber and fuel wood.
- over grazing by camels and other livestock⁽¹¹⁾.
- pollution; for example oil and other industrial pollutants⁽¹²⁾.

Natural threats to mangroves include:

- lack of inflow of fresh water - mangroves in the UAE often face this pressure as there are no natural inflow of fresh water from rivers or deltas.
- harsh environmental condition such as high temperature and high salinity of water can stunt the growth of mangroves as in the UAE.

Protecting Coastlines

Since mangrove forests are generally inaccessible due to their location in intertidal areas that are often comprised of very soft mud or sand, they are often seriously under-valued as important assets, not only in terms of biodiversity but also as protectors of the coast. With massive root systems, mangrove trees protect coastlines by absorbing and dissipating the force of large waves and storm surges, which can cause coastal erosion, property damage and even loss of life.

This protective capacity was vividly demonstrated during the Indian Ocean tsunami in December 2004. Studies of coastlines following this disaster showed that areas with mangrove forests better survived the worst impacts of the massive waves, undoubtedly saving both fragile coastal habitats and, possibly, thousands of lives.

Sadly, many mangrove areas along the Abu Dhabi shoreline have been lost to coastal development and urban expansion. More recently, efforts have been made to plant new forests and to preserve existing mangroves as a natural and resilient protector of the coast.

Adaptability of the Mangrove

From the earliest stages of life, mangroves display adaptability and the capacity for propagation and survival in an ever changing aquatic environment.

All mangroves produce buoyant seeds that float and disperse in water. Unlike land plants, most species of mangrove are viviparous with seeds that germinate while still attached to the mother plant.

The seeds germinate and grow within the fruit or out of it, and once the propagules or healthy seedlings mature they drop into the water. So begins an often long and hazardous journey in search of a suitable location to flourish. Often, the seedlings are transported long distances by water currents. The propagules can survive desiccation and may remain dormant for many days, even up to a year, until they find a suitable environment. Once the propagule is ready to take root, it changes density so that it floats vertically rather than horizontally and is more likely to become lodged within the mud or roots.

If it fails to take root, it alters density again and floats away on a continuing search for the best home.



A mangrove seedling taking root



The air breathing roots of a mangrove tree

Breathing Underwater

The bases of the trees are inundated daily by the tides and have to withstand a considerable amount of submersion.

Mangroves have a unique appearance with numerous pneumatophores (respiratory or prop roots) protruding all around, often many metres away from the trunk of the tree. These root like structures are basically 'breathing tubes' or snorkels covered by pores or lenticels, allowing oxygen transport within the plant.

Because of the excessive salt in their habitat, grey mangroves secrete salts directly from two glands at the base of each leaf. It is not unusual to see the leaves covered by salt crystals, hence the name grey or white mangrove.

Since freshwater is strictly limited in the salty soils of the intertidal zone, mangrove plants limit water loss through the pores or stomata on the leaves by restricting the size of pores. Furthermore, they can re-orient the leaves away from the harsh midday sun

and limit water loss by evaporation.

Life on the Root

Mangroves support unique ecosystems where the mesh of roots provides a tranquil marine environment for many organisms, especially the young and vulnerable.

Organisms can anchor themselves to the roots and simply wait for food and nutrients to sweep by on gentle currents. Where roots are permanently submerged, algae, barnacles, oysters, sponges and bryozoans take advantage of this anchorage to filter feed. Shrimps, lobsters and crabs – all with commercial value - use the muddy bottom as home while mangrove crabs improve the nutritional quality of the sediments with mulch by burying fallen leaves and debris.

Mangroves - Natural Filters

Since the underlying sediments of mangrove forests act as sinks for a variety of heavy trace metals found in seawater, mangrove removal disturbs the sediments and often leads to heavy metal contamination of surrounding habitats.

The following definitions are provided for the educator's reference. Young people should have the opportunity to explore definitions through individual activities. Some definitions may have been deliberately simplified for a young audience.

Anoxia

The term anoxia means a total decrease in the level of oxygen, an extreme form of hypoxia or "low oxygen".

Bryozoan

Any of various small aquatic animals of the phylum Bryozoa that reproduce by budding and form moss like or branching colonies permanently attached to trees, stones or seaweed.

Dredging

Any of various machines equipped with scooping or suction devices and used to deepen harbors and waterways and in underwater mining.

Germination

The beginning of growth, as of a seed, spore, or bud.

Intertidal

Of or being the region between the high tide mark and the low tide mark.

Lenticels

One of the small, corky pores or narrow lines on the surface of the stems of woody plants that allow the interchange of gases between the interior tissue and the surrounding air.

Mangal

A saline woody tree and shrub environment.

Pneumatophore

Aerial roots are roots above the ground. They are found in diverse plant species including orchids and coastal swamp trees such as mangroves

Propagation

Reproduction, and other forms of multiplication or increase.

Sediment

Sediment is naturally-occurring material that is broken down by processes of weathering and erosion, and is

subsequently transported by the action of fluids such as wind, water, or ice, and/or by the force of gravity acting on the particle itself.

Stomata

a stoma is a pore, found in the leaf and stem epidermis that is used for gas exchange.

Vivipary

Viviparous plants produce seeds that germinate before they detach from the parent. In many mangroves, for instance, the seedling germinates and grows under its own energy while still attached to its parent before dropping into the water in order to transport away.

References

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