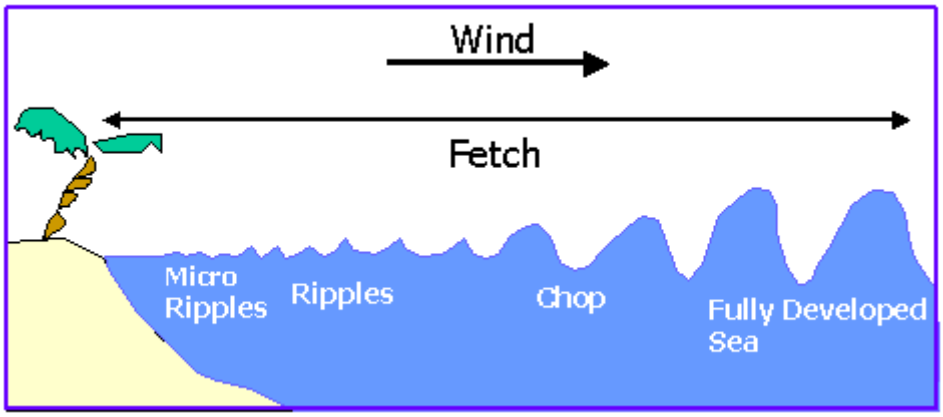
Tutopiya IGCSE Geography Summary Notes

Prepared by Tutopiya

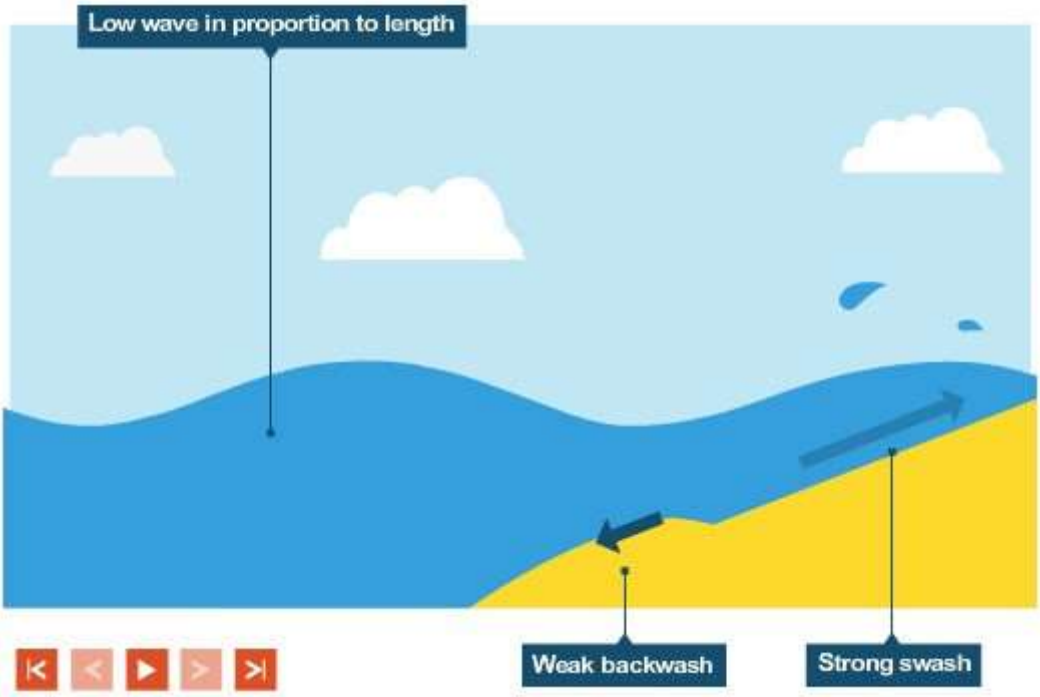
MARINE PROCESSES

Waves do much of the work of marine processes. They **erode, transport and deposit** materials. Waves are created by winds as they blow over the surface of the sea. It is the friction between the wind and water that sets waves in motion. The strength of waves depends on the strength of the wind depends on the strength of the wind. It also depends on the length of time and distance over which the wind has been blowing (the fetch).

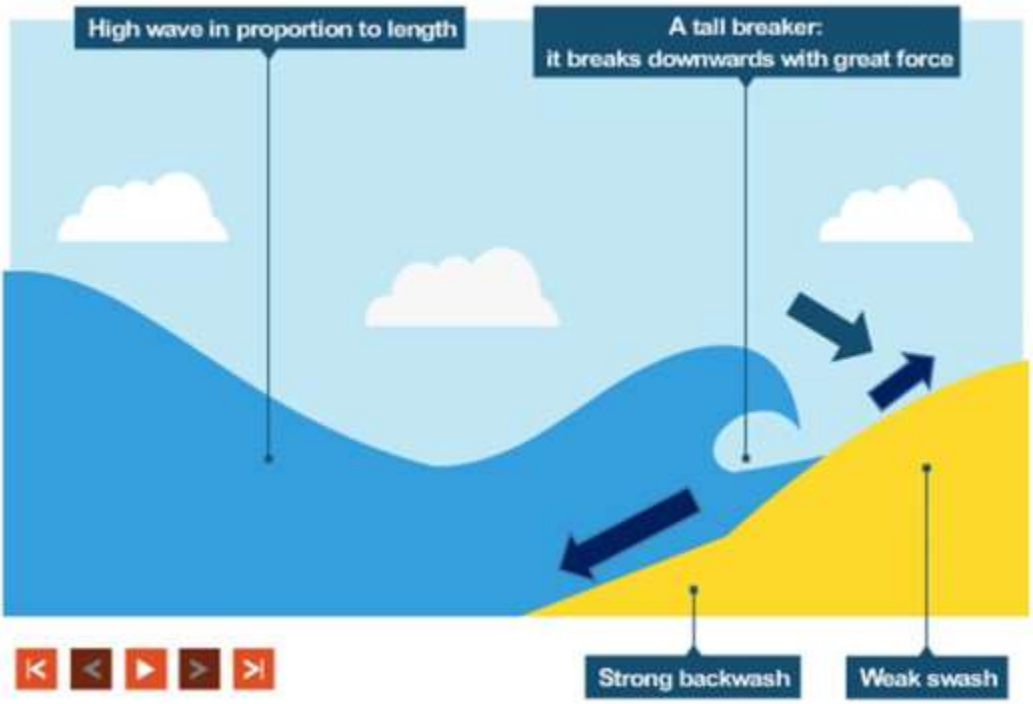


As waves near the coast, they enter shallower water. Friction with the seabed causes the wave to tip forward so that it eventually breaks. The resulting forward movement of the water, called the swash, runs up the beach until it runs out of energy. The water then runs back down the beach under gravity. This is called the **backwash**.

Constructive Waves



Destructive Waves



The balance between the swash and the backwash of waves created the difference between constructive and destructive waves. In constructive waves, the swash is stronger than the backwash. As a result, material is moved up the beach and much is left there (deposition). In

destructive waves, the backwash is stronger. Material is dragged back down the beach (erosion) and moved along the coast by Long Shore Drift (LSD).

Constructive waves have a large 'swash', which means they can carry deposits of sand and other materials far up the beach. They are much lower than destructive waves and have a longer 'wavelength': this is the distance between the peak of each wave, or the top. Constructive waves are made when the sea is calm.

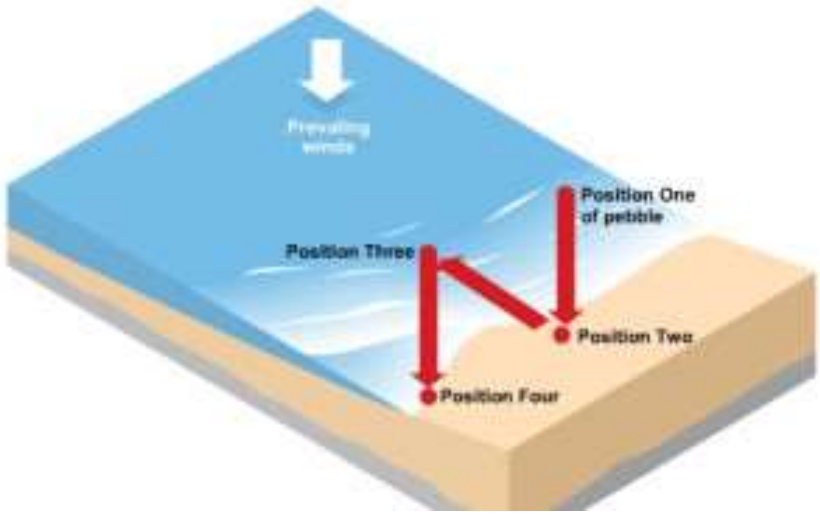
On the other hand, destructive waves are much larger and more powerful, and are mostly made during a storm. They have travelled a long way, and this is what makes them so powerful. Because they have a stronger backwash than swash, they erode the coastline because they take the sand back with them into the sea. There is a shorter distance between their peaks than with constructive waves (wavelength), and they are also much taller.

Processes of Erosion
It is destructive waves that do much of the erosion along a coast. They cut away at the coastline in several different ways:

- **Hydraulic action** – these results from the force of the waves hitting the cliffs and forcing pockets of air into cracks and crevices.
- **Abrasion** – this is caused by waves picking up stones and hurling them at cliffs and thus wearing the cliff away.
- **Corrosion** – the dissolving of rocks by the sea water.

Attrition is a process whereby the material carried by the waves becomes rounded and smaller over time as it collides with other material. It does not erode the coast as such but does form small pebbles and sand.

Long Shore Drift (LSD)



Once rocks are detached from the cliff, waves can move them along the coastline for quite long distances, this process is known as longshore drift. Generally speaking, the smaller the

material, the further it is likely to be moved by waves as it is lighter. Eventually, the waves are unable to move so many materials and the materials will be deposited to create new landforms.

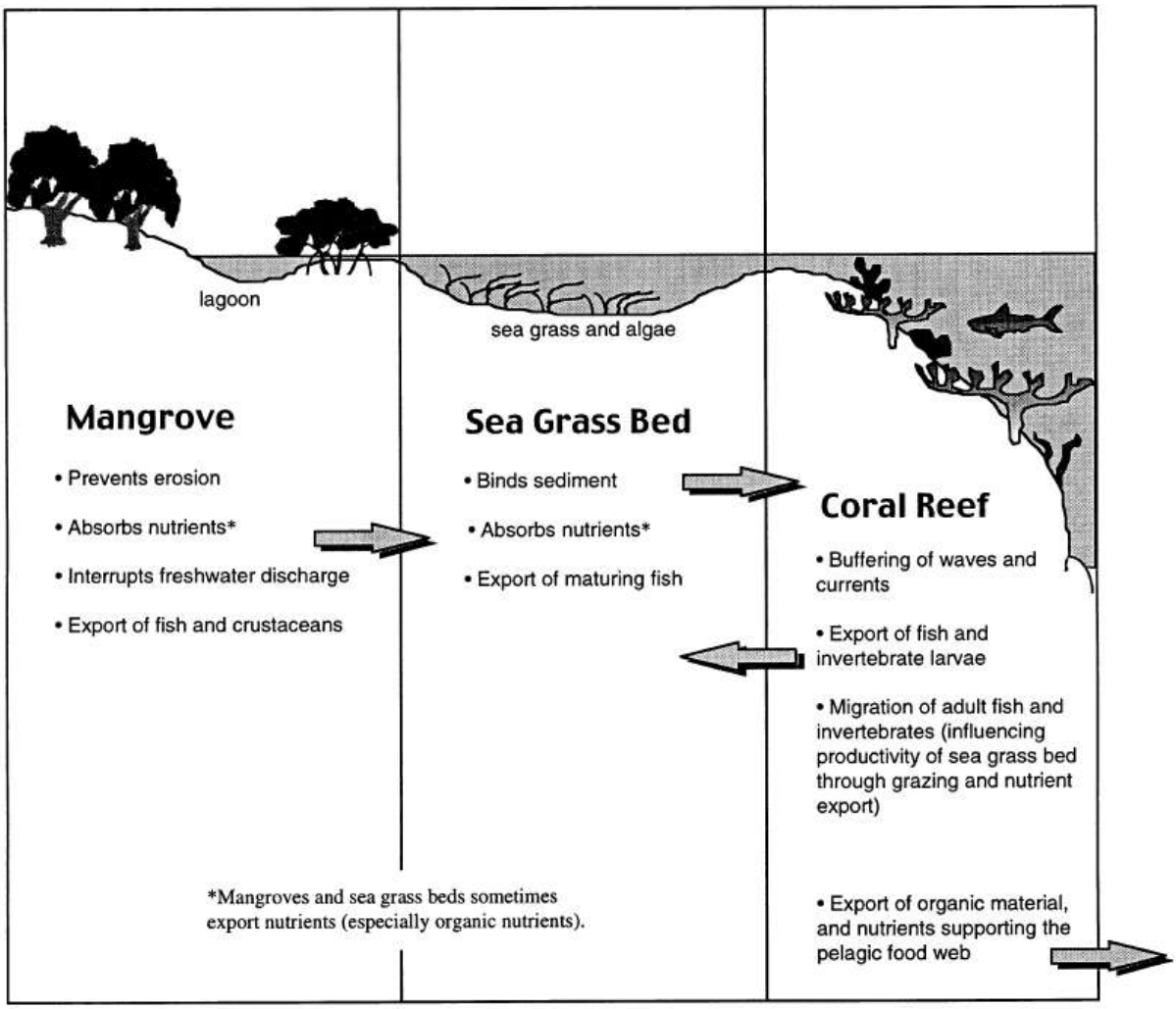
Land Processes
There are three main processes at work on the landward side of the coastline:

- **Weathering** – the breakdown of rocks which is caused by freeze-thaw and the growth of salt crystals, by acid rain and by the growth of vegetation roots.
- **Erosion** – the weathering away of rocks by wind and rain
- **Mass Movement** – the removal of cliff-face material under the influence of gravity in the form of rock falls, slumping and landslides.

COASTAL ECOSYSTEMS

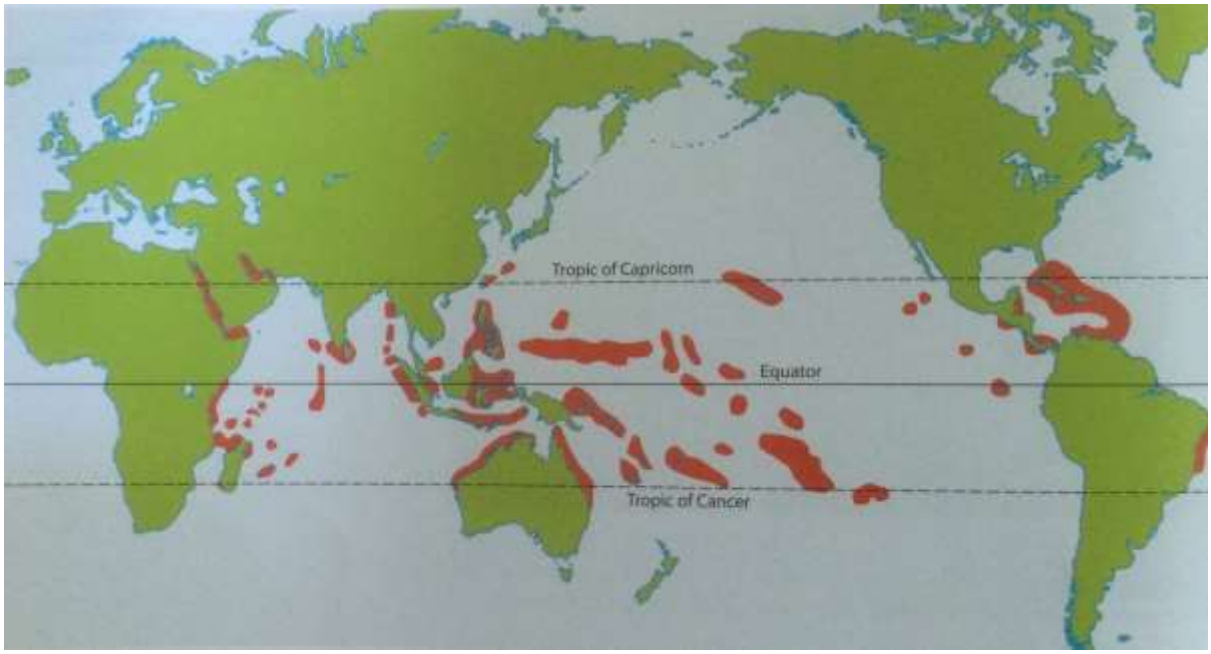
There are four main coastal ecosystems: Coral Reefs, Mangroves, Sand Dunes and Salt Marshes

Coral Reefs



Over time people have spread across the world and done a large amount of developing and settling because Coral Reefs are under water it can be easily forgotten how bio diverse they can be with a rich amount of life and a variety of ecosystems.

Distribution



Coral Reefs are huge deposits of calcium carbonate and are almost total comprised of living organisms (Coral). The distribution of Coral Reefs are controlled the following factors:

- **Temperature** – minimum 18°C but grows best at 23°C – 25°C so normally grow between the tropic of Capricorn and the tropic of Cancer.
- **Light** – Corals need light for photosynthesise and to survive.
- **Water Depth** – enough light is needed for Corals to photosynthesise and therefor survive and grow, so only grow in shallow waters of around 25 metres.
- **Salinity** – Coral can only survive in salt water.

At a local level, there are other factors affecting where Coral Reefs develop:

- **Wave Action** – Coral needs well oxygenated water and wave action provides this.
- **Exposure To Air** – whilst Corals needs oxygenated water it if they are exposed to air to long, they will be died.
- **Sediment** – if there is sediment in the water light might be blocked and sediment stops corals from feeding properly.

Coral Reefs with the highest biodiversity occur in South-east Asia and northern Australia. The Great Barrier Reef is in Australia and is removed not just for its great biodiversity, but also its extent and excellent condition.

Value

- **Fisheries** – Coral reefs are vital to the world's fisheries. They form the nurseries for about a quarter of the ocean's fish with around 1500 species of fish, and

thus provide revenue for local communities of many LIC as well as national and international fishing fleets.

- **Tourism** – Tourism revenues generated by coral reefs are also significant. For example, according to a report by the Key West chamber of commerce, tourists visiting Australia's Great Barrier Reef generates well over US$1 billion per year.
- **Coastal Protection** – Coral reefs break the power of the waves during storms, hurricanes, typhoons, and even tsunamis. By helping to prevent coastal erosion, flooding, and loss of property on the shore, the reefs save many of lives and lots of money each year.
- **Source of Medical Advances** – We can also expect coral reef species to contribute to future medical advances. Already coral reef organisms are being used in treatments for diseases like cancer and HIV. Just so long as they are alive and healthy.
- **Intrinsic Value** – For many coastal societies around the world, coral reefs and their inhabitants are intricately woven into cultural traditions. For these people – as well as for those who have floated with a mask and snorkel, immersed themselves in the three-dimensional wonderland of a scuba dive, or experienced these habitats through media and books – a world without coral reefs would be an infinitely poorer place.

Threats

The most damage that is done to Coral Reefs is done by mankind with the following:

- **Destructive Fishing Practices** – Things such as dynamite and cyanide fishing not just this but regular fishing like trolling can snag Coral with a net.
- **Overfishing** – This affects the ecological balance.
- **Tourism** – Careless boating, diving, and snorkelling causes damage such as anchors dropping on Reef.
- **Destruction of Mangroves** – The destruction of mangroves results in the depositing od sediment that clouds the water around coral reefs and killing coral.

Types Of Coral Reef

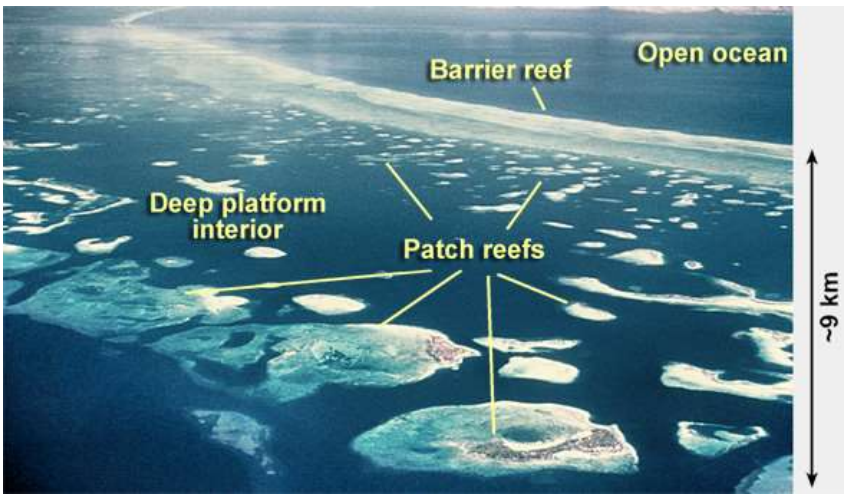
Coral reefs are divided into four classes: fringing reefs, barrier reefs, atolls, and patch reefs.

Fringing Reefs – Grow near the coastline around islands and continents. They are separated from the shore by narrow, shallow lagoons. Fringing reefs are the most common type of reef that we see.

Barrier Reefs – Also parallel the coastline but are separated by deeper, wider lagoons. At their shallowest point they can reach the water's surface forming a "barrier" to navigation. The Great Barrier Reef in Australia is the largest and most famous barrier reef in the world.

Atolls – Are rings of coral that create protected lagoons and are usually located in the middle of the sea. Atolls usually form when islands surrounded by fringing reefs sink into the sea or the sea level rises around them (these islands are often the tops of underwater volcanoes). The fringing reefs continue to grow and eventually form circles with lagoons inside.

Patch Reefs – Are small, isolated reefs that grow up from the open bottom of the island platform or continental shelf. They usually occur between fringing reefs and barrier reefs. They vary greatly in size, and they rarely reach the surface of the water.



Case Study: The Great Barrier Reef, Australia

The Great Barrier Reef is the world's largest coral reef system composed of over 2,900 individual reefs and 900 islands stretching for over 2,300 kilometres. The reef is in the Coral Sea, off the coast of Queensland, Australia.

The Great Barrier Reef can be seen from outer space and is the world's biggest single structure made by living organisms. This reef structure is composed of and built by billions of tiny organisms, known as coral polyps. It supports a wide diversity of life and was selected as a World Heritage Site in 1981. CNN labelled it one of the seven natural wonders of the world. The Queensland National Trust named it a state icon of Queensland.

A large part of the reef is protected by the Great Barrier Reef Marine Park, which helps to limit the impact of human use, such as fishing and tourism. Other environmental pressures on the reef and its ecosystem include runoff, climate change accompanied by mass coral bleaching, and cyclic population outbreaks of the crown-of-thorns starfish. According to a study published in October 2012 by the Proceedings of the National Academy of Sciences, the reef has lost more than half its coral cover since 1985.

The Great Barrier Reef has long been known to and used by the Aboriginal Australian and Torres Strait Islander peoples and is an important part of local groups' cultures and spirituality. The reef is a very popular destination for tourists, especially in the Whitsunday Islands and Cairns regions. Tourism is an important economic activity for the region, generating over $3 billion per year.

Mangroves

Mangroves are a tree or shrub which grows in tidal, chiefly tropical, coastal swamps, having numerous tangled roots that grow above ground and form dense thickets. It is thought that originate from South-east Asia and then spread across the globe. Because they grow in the intertidal zone, they live in a constantly changing environment.

Distribution

Distribution is controlled by the following factors of growth:

- **Temperatures** – Most mangroves grow only 30 degrees latitude of the equator.

- **Salinity** – The water around mangroves has to be of a certain salt content if not the mangrove will suffer, so if fresh water is added to salty water this would be harmful.
- **Exposer to Air** – Air is too rich in oxygen will harm to mangrove if the mangrove is exposed for too long.

Value

- **Contain Natural Resources** – Charcoal, firewood, fish, medicines and other substances can be extracted form mangroves.
- **Foraging and Living Place for Wildlife** – Without mangroves there would be no habitat for animals so there would be no animals.
- **Reducing Water Pollution** – The root systems of mangrove species absorb inorganic substances and reduce water pollution.
- **Protecting the Coastline** – Because the roots of a mangroves act can stabilise the coastlines of the river shores and river mouths. They also protect the coastline from wave erosion.
- **Flood Prevention** – Mangroves can stabilise water capacity of the substratum and on the soil surface, hence steady and retain water to prevent flooding.
- **Ornamental Value** – A mangrove forest is a beautiful environment with a diversity of life that in some peoples eyes is with saving.

Threats

- **Clearing** – Mangrove forests have often been seen as unproductive and smelly, and so cleared to make room for agricultural land, human settlements and infrastructure, and industrial areas.
- **Overharvesting** – While harvesting has taken place for centuries, harvesting of mangroves become unsustainable and threaten their future.
- **River Changes** – Dams and irrigation reduce the amount of water reaching mangrove forests, changing the salinity of water in the forest.
- **Overfishing** – The global overfishing crisis facing the world's oceans has effects far beyond the directly overfished population. The ecological balance of food chains and mangrove fish communities can also be affected.
- **Destruction of Coral Reefs** – Coral reefs provide the first barrier against currents and strong waves. When they are destroyed, the stronger-than-normal waves and currents reaching the coast can undermine the fine sediment in which the mangroves grow. This can prevent seedlings from taking root and wash away nutrients essential.
- **Pollution** – Fertilizers, pesticides, and other toxic man-made chemicals carried by river systems from sources upstream can kill animals living in mangrove forests.
- **Climate Change** – Mangrove forests require stable sea levels for long-term survival.

Case Study: Bangladesh, Sundarbans

The Sundarban forest lies in the vast delta on the Bay of Bengal formed by the super confluence of the Ganges, Padma, Brahmaputra and Meghna rivers across southern Bangladesh. The seasonally flooded Sundarbans freshwater swamp forests lie inland from the mangrove forests on the coastal fringe. The forest covers 10,000 square kilometres (3,900 sq mi) of which about 6,000 square kilometres (2,300 sq mi) are in Bangladesh. It became inscribed as a UNESCO world heritage site in 1997. The Indian part of Sundarbans is estimated to be about 4,110 square kilometres (1,590 sq mi), of which about 1,700 square kilometres (660 sq mi) is occupied by waterbodies in the forms of river, canals and creeks of width varying from a few meters to several kilometres.

The Sundarbans is intersected by a complex network of tidal waterways, mudflats and small islands of salt-tolerant mangrove forests. The interconnected network of waterways makes almost every corner of the forest accessible by boat. The area is known for the eponymous Royal Bengal tiger (Panthera tigris tigris), as well as numerous fauna including species of birds, spotted deer, crocodiles and snakes. The fertile soils of the delta have been subject to intensive human use for centuries, and the Eco-region has been mostly converted to intensive agriculture, with few enclaves of forest remaining. The remaining forests, taken

together with the Sundarbans mangroves, are important habitat for the endangered tiger. Additionally, the Sundarbans serves a crucial function as a protective barrier for the millions of inhabitants in and around Khulna and Mongla against the floods that result from the cyclones. The Sundarbans has also been enlisted among the finalists in the New 7 Wonders of Nature.

Salt Marshes

Salt marshes are coastal wetlands that are flooded and drained by salt water brought in by the tides. They are marshy because the soil may be composed of deep mud and peat. Peat is made of decomposing plant matter that is often several feet thick. Peat is waterlogged, root-filled, and very spongy.

Formation

The formation begins as tidal flats gain elevation relative to sea level by sediment accretion, and subsequently the rate and duration of tidal flooding decreases so that vegetation can colonize on the exposed surface.

Stages of Salt Marshes

- Estuary
- Mudflats
- Lower Marches
- Upper Marches

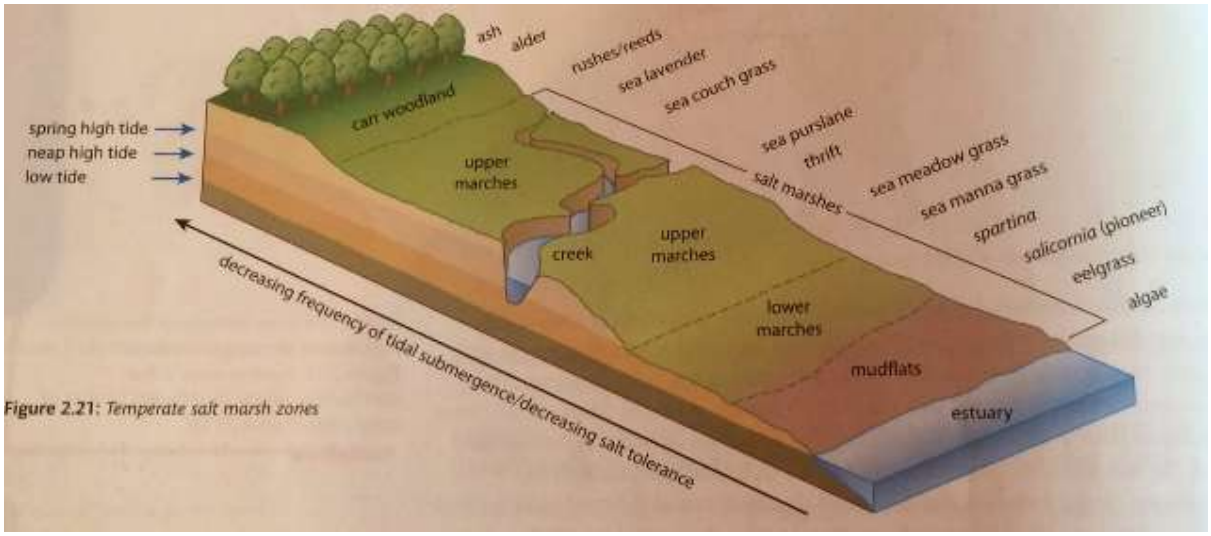


Figure 2.21: *Temperate salt marsh zones*

Distribution

Salt marshes occur in the upper coastal intertidal zone between land and open salt water or brackish water that is regularly flooded by the tides. It is dominated by dense stands of salt-tolerant plants such as herbs, grasses, or low shrubs. These plants are terrestrial in origin and are essential to the stability of the salt marsh in trapping and binding sediments. Salt marshes play a large role in the aquatic food web and the delivery of nutrients to coastal waters. They also support terrestrial animals and provide coastal protection.

Threats

- **Sea Level Rise** – Sea level is rising due to climate change and also because the land along the south east of England is tilting towards the sea.
- **Sea Defences –** Defences to protect the land from the rising sea may be built on saltmarsh or they may change the movement of the sediment necessary to maintain saltmarshes and mudflats.
- **Dredging –** Dredging to maintain the channels may also affect the movement of sediment and hence the state of the saltmarsh.
- **Coastal Squeeze –** Ideally saltmarsh need to be able to ‘move’ in response to changing conditions. Many saltmarshes are being ‘squeezed’ between the rising sea and fixed flood defence walls.
- **Erosion –** Wave action (including wash from boats) can damage and erode the marsh.

- **Disturbance by People –** Recreational use, for example by trampling and creating informal footpaths, can damage saltmarsh.
- **Land claim for farming or building –** Since medieval times, saltmarshes have been enclosed for agricultural use or destroyed to make way for building ports, harbours and other infrastructure. Nowadays this happens only in special cases.
- **Pollution from Land or Sea** – Oil, sewage, fertilizers, run off from old waste tipping.
  Oil pollution can damage saltmarsh vegetation and whilst it usually recovers, sediment may be lost during the period of die-back. Water pollution from sewage and fertilizers can lead to eutrophication. This is the excessive growth of green algae, which may cause local problems of smothering on saltmarshes.
- **Grazing –** Grazing can be beneficial if it controls coarse grasses, but sometimes it reduces the height of the vegetation and the diversity of plant and invertebrate species. This makes it less attractive as a breeding place for wading birds although they still use it in winter and when passing by on migration. Intensive grazing is a problem in some areas.
- **Colonisation by Cordgrass –** The small cordgrass, Spartina maritima, is the only species of cordgrass native to Great Britain. S. alterniflora, was introduced to the UK in the 1820s resulting in the hybrid cord grasses Spartina townsendii and S.anglica, which have invaded and dominated most of the marshes along the south coast.

Example – Chichester Harbour.

Sand Dunes

Sand dunes are a very important habitat. They are also a popular place for people to visit. However, they are very fragile environment and changes can take place quickly. To protect the dunes plants from being trampled too much, special wooden paths called ‘boardwalks’ are put down for people to walk on.

How Sand Dunes Are Formed

- Crest
- Horn
- Slip-face
- Back-slope

A dune is a mound of sand formed by the wind, usually along the beach or in a desert. Dunes form when wind blows sand into a sheltered area behind an obstacle. Dunes grow as grains of sand accumulate. Every dune has a windward side and a slip face.

Distribution

- Sand
- Beach
- Coast
- Wind

Types of Sand Dune

Embryo Dunes – At the frontline of the dunes is the youngest of dune called an embryo dune. This is a hostile environment for plants because of the salinity and a pH of 8-9. The alkaline pH is a consequence of the presence of shell fragments in the sand. This is also a very dry environment and the rapid drainage and exposed nature of the site make it difficult for plant growth.

Fore Dunes – Just shore wards of the embryo dunes are the older and slightly higher dunes called for dunes. Sometimes they are referred to as yellow dunes because of the high proportion (c. 20%) of visible sand. Here marram grass begins to dominate. Spreading like the couch with horizontal stems called rhizomes, it too can survive burial by the accumulating sands. Indeed, growth of the marram grass is stimulated by burial by sand. In common with the sea couch grass, it is also tolerant of salt.

Main Dunes – Are sand dunes that develop after the fore dunes appear. With an average depth of about 5m, with a soil to sand ratio bias to sand (hence yellow dunes). The moisture content of these dunes is relatively low, so the plants still have very strong root structure and are capable of getting every drop of water that comes their way.

Fixed Dunes – Are fixed, stable sand dunes located 50–100 m from the edge of the ocean. They are so named due to the presence of grasses and lichens such as the Cladonia species. The conditions for plant growth improve with increases distance from the beach. The pH in these grey or mature dunes is now much reduced and is now only slightly alkaline (perhaps 7.5) or even slightly acid (6.5). There is more shelter, and less salt is carried by the wind. With these better conditions the number and range of plants increases covering, in places, the entire sand surface. Less than 10% of the dunes are now visible sand.

Dune Slack – Between the fore dunes and the mature dunes are dune slacks which are low lying depressions. In winter these are often close to or even below the water table. This produces plant associations. Plants in the dune slacks include wild strawberries, buttercup and violets with some flag iris and willow in the slacks at the rear of the main dune system.

Dune Heath – If grazing pressure does not allow the development of scrub or woodland on the fixed dunes, the fixed dune grasslands will eventually develop into a different vegetation type. The surface of the soil continues to be leached by rainwater and this gradually washes out the basic minerals (especially calcium) which caused the high pH of the earlier successional stages.

Climax – Anything beyond the dunes e.g., trees, rocks, and civilization.

Values

- **Coastal Protection** – Sand dunes act as barriers protecting the land behind from storms.
- **Habitat** – Sand dunes are home to a small amount of life such as vegetation and nests of insects and birds.

Threats

- **Humans** – Humans are the only real threat to sand dunes as they destroy them for land or paths but this can lead to exposer to storms.