Salt marshes form in coastal areas that are well sheltered, such as creeks, inlets and estuaries where fine sediments can be deposited. They also form behind spits and artificial sea defences where tidal waters can flow gently and deposit fine sediments. They are typically very flat, with numerous muddy channels and creeks cutting through them.

Salt marshes start life as mudflats. Layers of mud build up as a mixture of very fine silts from tidal waters and alluvium from rivers dropping their load as they reach the sea, is deposited. These mud flats are covered at high tide and exposed as the tide drops. As the level of the mud builds less of it becomes regularly covered by the tide making it more stable. This allows pioneering plants like Eel grass to grow and their roots help to stick the mud particles together and trap even more sediment so the mudflats become more stable. As the mudflats continue to build up, different types of plants (colonizers like Glasswort and Cord Grass) can grow and live there creating a salt marsh habitat made up of blocks of flat low growing vegetation with narrow channels between. As the marsh continues to stabilize, the mud becomes less water logged and the salt content drops allowing plants like Sea Aster, Sea Lavender and Salt Marsh Grass to grow. These plants are followed by Sea Purslane, Sea Plantain and Sea Spurrey. Eventually, saltmarsh plants make way for scrub and trees.

The development of mudflats and salt marsh over time is known as succession.

**Succession**

Moving up the shore from the mudflats the saltmarsh starts and it shows a clear zonation according to how often it gets covered in sea water. At the lowest level the pioneer glassworts Salicornia spp can withstand immersion by as many as 600 tides per year, whereas species of the upper marsh can only withstand occasional inundation. The lower marsh has the fewest
species, the upper marsh a much more diverse community. Where the saltmarsh is grazed the vegetation is shorter and there are more grasses.

**Pioneer Species**

These are the first organisms to arrive in a new habitat. Pioneer plants may be very quick growing like some weeds or tolerant of difficult growing conditions, like the seaward end of a saltmarsh. However, once the mud in a saltmarsh starts to build up, other less hardy species will move in and the pioneer may be squeezed out. Glasswort and Annual Seablite are found on the lower part of the saltmarsh, but Sea Lavender, Sea Purslane and Saltmarsh Grass take over further up. However, if there is a hollow or pool in this higher area you will find Salicornia and Seablite again.

The plants that grow on saltmarsh are halophytic – salt tolerant.

Saltmarshes are important areas for small creatures such as worms, shrimps and shellfish, fish, wading birds and wildfowl. They provide nursery areas for fish, food for waders and wildfowl and nesting sites for waders and seabirds. Many of the plants growing on saltmarsh are not found anywhere else. Farm animals may graze on the upper parts of the saltmarsh. Saltmarshes may help with defence against the sea as they can reduce the force of the waves hitting sea walls.
Formation of the Saltmarsh

Saltmarshes form in sheltered areas; in bays protected by headlands, behind spits and offshore islands and in tidal estuaries.

Open Mud

Mudbank

↓

Stabilized by algae

↓

Pioneer terrestrial species

Eel Grass

Lower Marsh

has a high concentration of salt in its sediment.

Unstable.

Is covered for 50% of the day by the tide which leads to waterlogged soil which is anaerobic below the surface.

Colonizers

Glasswort

Cord Grass

Middle Marsh

is stable. It shows a transition from saltmarsh to dry land.

Salt content of the soil is low.

Sea Aster

Sea lavender

Salt Marsh Grass

General Salt Marsh

Sea Lavender

Sea Purselane

Sea Plantain

Sea Spurrey

The marsh accretes vertically and spreads horizontally towards the sea.

As the level of silt rises plants are submerged less and less.

As it grows the marsh needs more sediment to extend. Without an increase in the supply growth declines with increasing size.
Ecological Processes at work in the Salt Marsh

Salt marsh is a difficult habitat in which to live. The environmental processes at work on the saltmarsh lead to environmental stresses being set up which the plants and animals living there have to adapt to.
Saltmarsh lies between the Mean High Tide and Highest Spring Tide and the ecology of the saltmarsh is determined by the fact that it is tidal and submerged by salt water for much of the time.

This leads to

1. Reduced light.
2. Reduced oxygen supply to the leaves of marsh plants.
3. Clogging of stomata by mud particles.
4. The tidal movement has a dragging effect on the plants which can cause tissue damage.
5. Salinity of the soil:
   - Saline water contains quantities of sodium, chloride, magnesium and sulphate that are toxic to plants. Sodium and chloride interfere with the uptake of essential nutrient ions in plants.
   - Salt crystallizing on plant leaves draws water out of the plant tissue.
   - Lack of fresh water leads to conditions similar to those found in deserts, i.e. physiological drought.
   - Reduces the amount of oxygen available to plant roots.
   - Anaerobic conditions.
7. Unstable sediment.
8. Tides can dislodge animals from their habitats and carry them away.
9. 'Marine' organisms are at risk of desiccation when the marsh is exposed to the air. Invertebrates of terrestrial origin which are air breathing are at risk when the marsh is covered by the tide.

- The time that the marsh spends submerged varies with the tidal cycle, meteorological conditions, local coastal variation and seasonal fluctuation.
- The amount of time the saltmarsh habitat spends submerged changes with its distance from the water's edge.
- As the height of the marsh rises the number of flooding tides that cover it fall.
- A gradient is set up running from the water's edge to the top of the marsh along which:
  (a) the period of submergence declines
  (b) the salinity of the soil decreases.
  (c) the aeration of the soil and drainage improves
  (d) the amount of organic matter in the soil increases.

This gradient influences the plant and animal populations living there. Different species of plant and animal can be found at different levels above the water line depending on their ability to cope with the environmental stresses as they occur along the gradient.
This reflects the pattern of zonation of colonization and succession.
Threats to salt marsh

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
Saltmarsh is found at only a few places in Sussex: mainly at the harbours of Rye, Chichester and Pagham and along the tidal reaches of the Rivers Rother, Cuckmere and Adur. The total amount of saltmarsh recorded in the region during the 1998 national survey was 816 ha. This is 4% of the resource on the North Sea Coast and 2% of that in Britain. More recently the BRANCH Project calculated the Sussex extent of saltmarsh as 405 hectares. This implies that we have approximately half of the saltmarsh resource previously audited.

The saltmarsh at Cuckmere Haven represents a tenth of the total saltmarsh in Sussex. It is typical of the saltmarsh found along the south coast. It has formed on deposits of clay and silt eroded from the sedimentary rock of the Seven Sisters.

The saltmarsh is vegetated by a sea purslane community and the plants include sea couch grass, saltmarsh grass, glasswort, sea aster, sea spurrey and seablite. Seabeet can be found along the edge of the canal path with red fescue grass and sea wormwood.