Salt marshes are vegetated mud flats. They are above mean sea level in the intertidal area where higher plants (angiosperms) grow. Sea grasses are an exception to the generalization about higher plants because they live below low tide levels. Mud flats are vegetated by algae.

**Geomorphology**

Salt marshes and mud flats are made of soft sediments deposited along the coast in areas protected from ocean surf or strong currents. These are long-term depositional areas intermittently subject to erosion and export of particles. Salt marsh sediments are held in place by plant roots and rhizomes (underground stems). Consequently, marshes are resistant to erosion by all but the strongest storms. Algal mats and animal burrows bind mud flat sediments, although, even when protected along tidal creeks within a salt marsh, mud flats are more easily eroded than the adjacent salt marsh plain.

Salinity in a marsh or mud flat, reported in parts per thousand (ppt), can range from about 40 ppt down to 5 ppt. The interaction of the tides and weather, the salinity of the coastal ocean, and the elevation of the marsh plain control salinity on a marsh or mud flat. Parts of the marsh with strong, regular tides (1 m or more) are flooded twice a day, and salinity is close to that of the coastal ocean. Heavy rain at low tide can temporarily make the surface of the sediment almost fresh. Salinity may vary seasonally if a marsh is located in an estuary where the river volume changes over the year. Salinity varies within a marsh with subtle changes in surface elevation. Higher marshes at sites with regular tides have variation between spring and neap tides that result in some areas being flooded every day while other, higher, areas are flooded less frequently. At higher elevations flooding may occur on only a few days each spring tide, while at the highest elevations flooding may occur only a few times a year.

Some marshes, on coasts with little elevation change, have their highest parts flooded only seasonally by the equinoctial tides. Other marshes occur in areas with small lunar tides where flooding is predominantly wind-driven, such as the marshes in the lagoons along the Texas coast of the United States. They are flooded irregularly and, between flooding, the salinity is greatly raised by evaporation in the hot, dry climate. The salinity in some of the higher areas becomes so high that no rooted plants survive. These are salt flats, high enough in the tidal regime for higher plants to grow, but so salty that only salt-resistant algae can grow there. The weather further affects salinity within marshes and mud flats. Weather that changes the temperature of coastal waters or varying atmospheric pressure can change sea level by 10 cm over periods of weeks to months, and therefore affect the areas of the marsh that are subjected to tidal inundation.

Sea level changes gradually. It has been rising since the retreat of the continental glaciers. The rate of rise may be increasing with global warming. For the last 10 000 years or so, marshes have been able to keep up with sea level rise by accumulating sediment, both through deposition of mud and sand and through accumulation of peat. The peat comes from the underground parts of marsh plants that decay slowly in the anoxic marsh sediments. The result of these processes is illustrated in Figure 1, in which the basement sediment is overlain by the accumulated marsh sediment. Keeping up with sea level rise creates a marsh plain that is relatively flat; the elevation determined by water level rather than by the geological processes that determined the original, basement sediment surface on which the marsh developed. Tidal creeks, which carry the tidal waters on and off the marsh, dissect the flat marsh plain.

**Organisms**

The duration of flooding and the salinities of the sediments and tidal waters control the mix of higher vegetation. Competitive interactions between plants and interactions between plants and animals further determine plant distributions. Duration of flooding duration controls how saturated the sediments will be, which in turn controls how oxygenated or reduced the sediments are. The roots of higher plants must have oxygen to survive, although many can survive short periods of anoxia. Air penetrates into the creekbank sediments as they drain at low tide.
Saltwater marshes and mudflats form as saltwater floods swiftly and silently up winding creeks to cover the marsh before retreating again. This process reveals glistening mud teeming with the invisible life that draws in thousands of birds to feed. When the accumulating mud rises above the water surface saltmarsh plants can colonise. These capture more sediment and allow the marsh to keep building for as long as it is still low enough to be flooded by the higher tides. Distribution in the UK. Found in sheltered estuaries and natural harbours around the UK. What to look for. Differences between salt marshes and mud flats. Salt marsh—Often inundated with sea water, silt and mud Wet environment Hydrophytic (wet tolerant) Mud Flats—Often inundated with wind blown sand Xerophytic adaptations (dry tolerant) Dry environment. This set is often saved in the same folder as Wind and Waves. Salt marshes and mud flats at the mouth of an estuary. The water in estuaries is known as brackish: a mixture of fresh water from rivers and salty sea water. Plants and animals that live in estuaries are adapted to brackish water. Many different plants and animals make mud/sand flats and salt marshes their home and are flooded regularly by the sea. Why are salt marshes important? Wildlife Biofilms (that include diatoms, a type of algae) found on mud and sand flats provide food for animals that live in the mud/sand; like worms, snails and shrimp. Nutrient cycling: the nutrients that saltmarsh plants need to grow comes from the land and the sea. The incoming tide brings nutrients to the plants and in turn the plants provide organic matter to the marine food chain.