

**THE NEWLY FORMING DUNE BELT IN SOUTH CLEETHORPES. HERE THE BROAD SANDY FORESHORE EXPOSED AND DRY AT LOW TIDE OFFERS A LARGE SAND SUPPLY WHICH CAN BE BLOWN BY ONSHORE WINDS TO THE BACK OF THE BEACH TO ACCUMULATE AND BEGIN THE SAND DUNE SUCCESSION (PSAMMOSERE).**





**ON THE BEACH SAND IS MOVED BY SALTATION. SAND GRAINS MOVE UP THE BEACH FROM RIGHT TO LEFT, MOVING IN A SERIES OF SMALL JUMPS. THIS FORMS THE SAND RIPPLES SHOWN ON THE IMAGE ABOVE AND ANY OBSTACLES ON THE BEACH SLOW DOWN THE WIND SPEED TO CAUSE THE ACCUMULATION OF SAND, AS SEEN IN THE CENTRE OF THE IMAGE.**

**A VIEW FROM THE EMBRYO DUNES AT THE FRONT OF THE DUNE BELT ACROSS THE BROAD BEACH AT LOW TIDE OUT TO THE HUMBER ESTUARY AND THE NORTH SEA BEYOND. THE VEGETATION GROWS ON THE SANDY BEACH WHICH IS VERY LOW IN NUTRIENTS. AND ALKALINE IN NATURE.**





**HERE PIONEER PLANTS SUCH AS MARRAM GRASS AND LYME GRASS BEGIN TO COLONISE THE INCIPIENT DUNE SYSTEM. THESE PIONEER PLANTS ANE HARDY XEROPHYTES WHICH TOLERATE THE DRY, SANDY CONDITIONS AND HALOPHYTES WHICH TOLERATE THE SALTY CONDITIONS FOUND ON THE FORESHORE.**



**THE PIONEER PLANTS AND EARLY COLONISERS SLOW DOWN THE SPEED OF THE WIND AND REDUCE THE ABILITY OF THE WIND TO TRANSPORT SAND AND CAUSE IT TO ACCUMULATE AND THE DUNES BEGIN TO GROW INTO A RIDGE. THIS SAND IS HELD MORE PERMANENTLY BY THE VEGETATION AND ITS ROOTS**



**HERE THE EMBRYO DUNES ARE JUST BEGINNING TO GROW AND BEHIND THEM ARE THE MORE PERMANENT FOREDUNES. THESE PIONEER PLANTS AND EARLY COLONISERS HAVE DEEP TAP ROOTS TO REACH WATER FOUND AT DEPTH BELOW THE SAND AND THIN, OFTEN FOLDED LEAVES TO REDUCE THE LOSS OF WATER BY TRANSPIRATION.**

**FURTHER BACK IN THE SAND DUNE SUCCESSION THERE IS AN INCREASE IN GROUND COVER AND PLANT HEIGHT. HERE WE SEE AN INCREASE IN BIOMASS AND BIODIVERSITY AS THICKETS OF SHRUBS SUCH AS SEA BUCKTHORN AND OTHER LATE COLONISERS BEGIN TO DOMINATE.**



**DURING THE SUCCESSION COMPETITION IS A MAJOR PROCESS AS STRONGER, TALLER PLANTS OUTCOMPETE THE PIONEER PLANTS AND EARLY COLONISERS FOR SUNLIGHT AND SPACE. FACILITATION IS ALSO A MAJOR PROCESS AS EARLIER PLANTS PAVE THE WAY FOR LATER ONES BY ADDING ORGANIC MATTER AND HUMUS TO THE SOIL TO MAKE IT MORE FERTILE AND LESS ALKALINE.**





**THE DYNAMIC NATURE OF THE COASTAL ENVIRONMENT IS ILLUSTRATED BY THE FACT THAT THE DUNE BELT HAS MOSTLY CUT THE SALT MARSH, FOUND TO THE REAR, OFF FROM THE SEA. THERE IS STILL ONE CREEK, SHOWN HERE THAT ALLOWS THE HIGHER TIDES TO FLOOD THE MARSH. HERE IN THE SHELTERED, LOW ENERGY ENVIRONMENT FINE SILTS ARE DEPOSITED, AIDED BY THE PROCESS OF FLOCCULATION, AS FINE SEDIMENTS STICK TOGETHER IN THE BRACKISH ENVIRONMENT.**



HERE IN THE SALT MARSH, HALOPHYTIC PLANTS THAT CAN TOLERATE THE SALTY ENVIRONMENT SUCH AS SALICORNIA AND SPARTINA SLOW DOWN THE FLOW OF WATER AT HIGH TIDE AND PROMOTE THE ACCUMULATION OF SILT AND CLAY. LATER COLONISERS LIKE SEA ASTER AND SEA LAVENDER ADD GREATER BIODIVERSITY AND THE MARSH IS COVERED BY FEWER AND FEWER TIDES. NOW ONLY THE VERY HIGHEST TIDES COVER THE MARSH AND RAINFALL AND STREAMS FROM THE LAND REDUCE THE SALINITY AND ALLOW MORE FRESHWATER MARSH PLANTS SUCH AS SEDGES AND COTTON GRASS TO GROW.



**HERE AT THE REAR OF THE SALT MARSH IS A CONCRETE REINFORCED EMBANKMENT TO PREVENT THE FLOODING OF SOUTH CLEETHORPES. BEYOND THIS IS THE ORIGINAL RECLAIMED SAND DUNE BELT. THE DEVELOPMENT OF THE COASTLINE IS NOW DEPENDENT ON THE BALANCE BETWEEN RISING SEA LEVELS AND THE NATURAL PROCESSES OF SAND DUNE AND SALT MARCH FORMATION THAT BUILD UP THE COASTLINE.**



