



SAND DUNES OF EAST HEAD

Over the centuries sand dunes have become established upon East Head, a sand and shingle spit. There are very few sites of dune development along the south coast of England, and so East Head has important conservation status and is designated a Site of Special Scientific Interest (SSSI).

Sand dunes are a dynamic ecosystem, they are constantly changing. The process by which an ecosystem changes over time is called succession. Sand dunes are formed when bare sand starts to be colonised by plants. Over time, the sand builds up into dunes, raising the height of the ground above sea level. Succession in sand dunes is called a psammosere.

HOW ARE SAND DUNES FORMED?

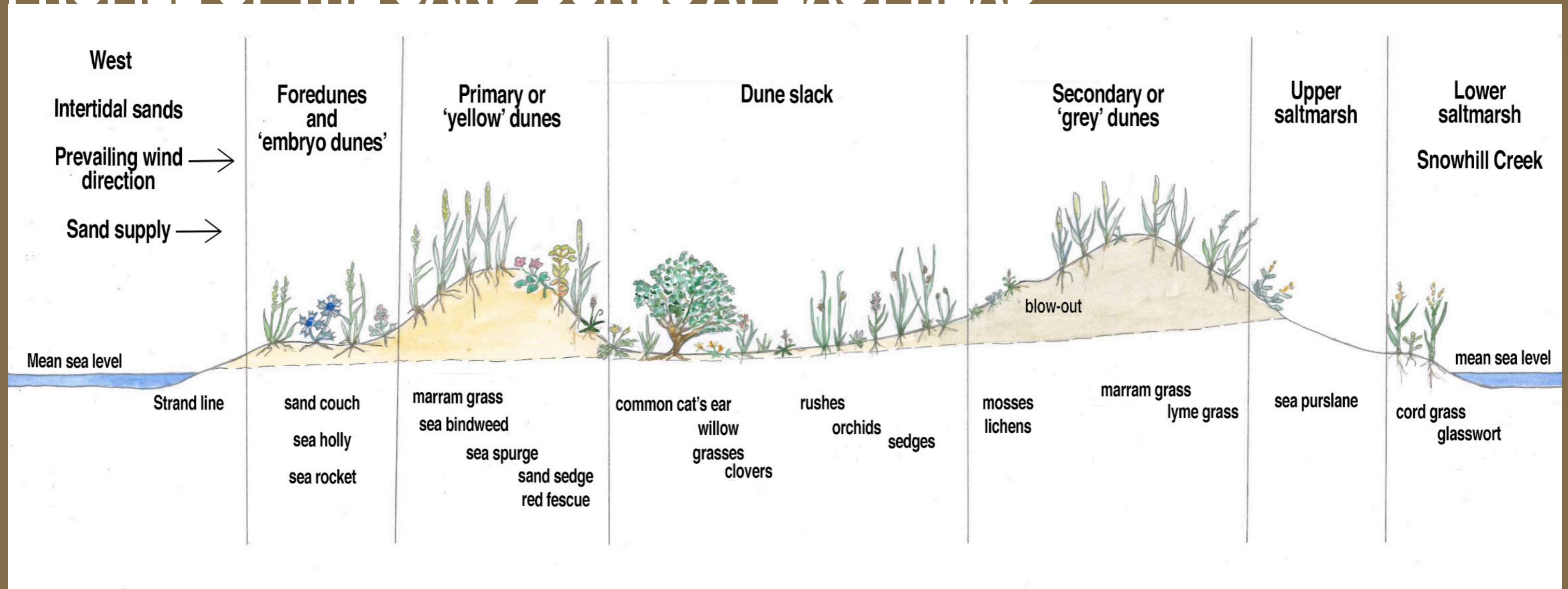
There are several factors that must operate together for sand dunes to form. These include:

- 1] A steady supply of sand.** Most of the sand on East Head comes from the Winner sandbank at the Harbour entrance. The Winner is replenished by constructive wave action which usually occurs during the summer months, when the sea tends to be calmer.
- 2] A large tidal range.** At the mouth of Chichester Harbour, the height of the high tide and low tide can range from 5.3m to 0.3m during a Spring tide. This exposes a large, flat surface area of fine sand which can dry out for several hours.
- 3] Onshore winds.** At East Head, the prevailing onshore winds are from the southwest, which encourages a net movement of sand from the Winner towards the spit. When the wind is moving at sufficient speed, it picks up grains of sand and transports them to the back of the beach. Single grains take to the air and leap and bounce landwards; as they fall, they dislodge a couple more grains of sand, which in turn take to the air and do the same. This process of movement is called saltation.
- 4] An obstruction to trap the sand.** As the sand reaches the top of the beach, there needs to be an obstruction to start trapping the sand. This is often driftwood or other debris along the strandline.
- 5] Vegetation.** Sand that is trapped, starts to be colonised by plants. Seeds and spores are blown by the wind, landing on the trapped sand where they begin to germinate and grow. The first species that colonise the sand are called pioneer species. As they grow, they stabilise the sand, encouraging more sand to accumulate there. Embryo dunes start to form.

SUCCESSION AND PLANT COLONISATION ACROSS THE DUNES

Once the embryo dunes form and plants start to colonise the sand, succession leads to the gradual development of the sand dune ecosystem. The psammosere on East Head is now well-established and can be divided into different zones which represent different stages of succession, known as the seral stages. Within each seral stage, succession has altered the environment leading to changes in the soil and microclimate which has gradually favoured the establishment of the next group of plant species. As a result, a sequence of distinct vegetation communities is observed. Below is a cross section of the north-central sand dunes on East Head.

PROFILE OF THE SAND DUNES AT EAST HEAD



Within each seral stage, different plants colonise the zone depending on the environmental conditions:

EMBRYO DUNES AND FOREDUNES



embryo dune



sea holly
(*Eryngium maritimum*)



sea rocket
(*Cakile maritima*)



sand couch grass
(*Elytrigia juncea*)

Embryo dunes will grow if the rate at which sand is trapped is greater than the rate removed by the wind. Conditions are harsh on embryo dunes for any plants to grow. They are very exposed to winds, salt spray, extreme temperature range, shifting sand with little nutrients and minimal fresh water. The pioneer plants that grow must be adapted to cope with this harsh environment. Many of these stress-tolerant plants are halophytes (adapted to high salinity levels) or xerophytes (adapted to low moisture content).

Along East Head, a few specialised species such as sea holly, sea rocket can be found growing at either end of the spit and sand couch grass is often found on embryo dunes along the west side. All these plants are halophytes.

Following on behind the embryo dunes are the slightly higher foredunes. Sand couch grass continues to grow well here. As it grows taller, it offers more resistance to the wind, encouraging more sand to accumulate.

YELLOW AND GREY DUNES



marram grass
(*Ammophila arenaria*)



sea bindweed
(*Calystegia soldanella*)



lyme grass
(*Leymus arenarius*)

The dunes behind the foredunes are known as the Primary or Yellow dunes. The yellow dunes are so called because they are young dunes and consist of relatively fresh, pale yellow sand. A greater variety of dune plants start to grow here as the conditions are less saline and have some protection from the foredunes. The sand also contains more organic matter following the death and decay of pioneer vegetation. This increases the nutrient level in the sand and its water

holding capacity. The most dominant species to grow here is marram grass, but you often find sea bindweed and lyme grass growing amongst it. These are all xerophytic plants.

Once over the top of the yellow dunes, the environment becomes much more sheltered and increasingly favourable for a greater range of plants. You usually find plants such as sea spurge (Euphorbia paralias), common catsear (Hypochaeris radicata), lesser hawkbit (Leontodon hispidus) and sand sedge (Carex arenaria) growing here.

The grey dunes or secondary dunes on the east side of East Head are the oldest dunes and contain organic matter from plant material that has broken down over a long period of time. The sand is darker in colour and contains more nutrients which encourages a greater species diversity. A ground cover of moss and lichen also darkens the tone of the surface.



sea spurge
(*Euphorbia paralias*)



common catsear
(*Hypochaeris radicata*)



sand sedge
(*Carex arenaria*)

DUNE SLACK



In the centre of East Head is a large area of dune slack. This is where the level of the sand has dropped down closer to the water table. This area of the sand dunes is relatively mature, and moisture loving plants have become established. These includes rushes (*Juncus* spp.), sedges (*Carex* spp.), wild orchids and willow bushes (*Salix* spp.).



willow bush
(*Salix* spp.)



rush
(*Juncus* spp.)



early purple orchid
(*Orchis mascula*)

BLOWOUTS

Sometimes blow outs can occur along the sand dunes. This can happen when a damaged area of the dunes has become unstable and consequently been knocked back down to bare sand by a combination of erosion and strong winds.



SUCCESSION AND CLIMAX VEGETATION

In general, progressing from the strandline from west to east, the sand dunes on East Head gradually become older, plant communities have had longer to adapt and modify their environment, conditions become less demanding and plant diversity and biomass increase. The final stage of succession is known as the climax community, the ecosystem is supporting the largest and most complex community it can and has reached equilibrium with the environment. Within a typical psammosere, this is often woodland and shrubs.

On East Head however, it is difficult to see this trend in vegetation communities clearly away from the foredunes and yellow dunes. The overall association of the different vegetation groupings often appears more like a mosaic than an orderly sequence. The climax community of woodland has not developed. These variations are likely to be due to a number of factors: i) the shape of East Head and its relatively small size ii) East Head is surrounded by sea on all sides iii) the active planting of marram grass since the 1960s to help stabilise the dunes iv) the rabbit population suppressing growth of vegetation v) human trampling.

HOW ARE PLANTS ADAPTED TO COPE WITH THE CONDITIONS IN THE SAND DUNES

Plants have adapted in different ways to cope with the harsh environment on the dunes. Below are 3 examples of how different plants have adapted.

MARRAM GRASS (*Ammophila arenaria*)

Marram grass is xerophytic and a key plant for building and stabilising the dunes. It thrives on fresh coverings of sand, which stimulates its vertical growth and spread. It has an extensive system of rhizomes (fleshy roots) which allows it to colonise areas quickly. The roots penetrate deeply into the sand in the search for fresh water which also helps to keep it in place in strong winds and bind the sand together. The leaves grow up to the surface from the rhizomes and are adapted to reduce water loss by transpiration. The leaves curl inwards to maintain high humidity around each leaf and lower the exposed surface area. There are hairs on the inner surface of the leaves to help trap humid air. The stomata are also located here and are sunken in pits. The leaves have a thick waxy cuticle to help reduce water loss.



SEA SPURGE (*Euphorbia paralias*)

Sea spurge is a low growing plant often found growing on the east side of the yellow dunes. It has succulent leaves and stems that retain water. The cells in the tissues of the plant are able to store high levels of salt creating a low osmotic potential, enabling the plant to take up water from salty sand through its roots by osmosis. The leaves are small with a low surface area and have a thick waxy cuticle to reduce water loss by transpiration and protect against abrasive sand-laden winds. When the plant is buried in shallow levels of sand, it encourages growth of new shoots from the base and the spread of the plant.



COMMON CATSEAR (*Hypochaeris radicata*)

Common catsear is a low growing plant, its leaves are arranged in a rosette on the ground. It can only tolerate being buried by small amounts of sand, so it is not found growing close to the sea.

The arrangement of the leaves on the ground helps to reduce water loss. Any water transpired from the lower surface of the leaf rosette will condense back into the sand. The leaves and stems also have fine hairs which help to increase humidity around the plant and hence reduce transpiration. The plant has a long tap root to anchor it and reach water deep in the sand.



WILDLIFE FOUND LIVING ON EAST HEAD

The sand dunes are an ecosystem and home to a range of creatures as well as plant species. Spotting a sand lizard is a real treat as they are a rare species in Britain. Male sand lizards have bright green markings during the breeding season. Females are a more modest sandy colour all year round. You are more likely to see their footprints in the sand dunes on the western side of the spit.



sand lizard

Between April and June ringed plovers can be found at the northern end of East Head. They nest on shingle where their eggs are camouflaged perfectly among the pebbles. The National Trust rope off this area to help protect the young birds and encourage owners to keep their dogs on leads.



ringed plover
the wildlife trust

A host of insects also call East Head home. Over one hundred species of moth have been recorded on East Head including the rare shore wainscot and the magnificent elephant hawk moth. Colourful day flying moths are a common sight in summer months along with their caterpillars. The black and red spotted burnet moth or the stripey yellow and black caterpillars of the cinnabar moth can often be seen.



elephant hawk moth
butterfly conservation.org



skylark
wikipedia

East Head is also home to the skylark, a small brown bird with a very distinctive song when in flight. It is wonderful to see them at East Head as the skylark is a Red List species due to its recent and dramatic population decline.



cinnabar moth caterpillar
sussex wildlife trust

MANAGEMENT OF THE SAND DUNES

Thousands of visitors come to East Head every year, whether it be to walk their dog, enjoy a family day out at the beach, take a break from sailing or just enjoy the Harbour views. The National Trust who own East Head, manage the conservation area so that the wildlife and habitat is protected, but also enable people to access this beautiful landscape. They use a number of management techniques to try to achieve this balance:

PHOTO: ROB WIGGINS



BOARDWALKS

Boardwalks have been constructed to encourage people to enter the dunes at certain points and follow key routes through the dunes to minimise trampling of the vegetation.

DOG LITTER BINS

To encourage dog walkers to clear up after their dogs, the National Trust have placed dog litter bins at key locations.



SIGNAGE

Information boards have been placed at key sites to inform the public about the dunes, the wildlife and recommended behaviour to help protect the conservation area.

All these management techniques do however rely on visitors respecting the area and adhering to the advice given. Unfortunately, there is a minority who choose to ignore it, and the wildlife and landscape consequently suffer. An abandoned barbeque burnt a large area of the dunes to the ground. Dogs regularly chase birds, frightening and exhausting them and potentially harming nests and chicks on the shingle. Fragile areas of dunes are trampled by people walking across fenced off areas. Discarded litter impacts on the environment and poses a threat to wildlife. It is hoped that through further education and awareness, people will understand the consequences of their actions and wish to protect the area for all to enjoy.



ROPE FENCING

Particularly fragile areas of the dunes are sectioned off by rope fences to discourage people from walking over these areas. If the plants are trampled and destroyed, the dunes become under increased threat of erosion and blowouts.

