

How sand dunes form and evolve

Sand dunes build up when sand, exposed at low tide, dries out. Wind can then pick up the grains which 'bounce' along in a process known as saltation, until they meet an **obstacle**, such as debris at the strand line around the high water mark. Here the grains accumulate and build up, as small mounds, called **embryo dunes**. These can build up by 1 metre a year.



The next stage of dune formation is when plants begin to grow on the embryo dunes. The most common plant here is marram grass. **Fore dunes** build up when the

sand is held by the roots of this grass, which is said to be able to grow up through 30 cm of sand each year. These dunes can rise to around 10 to 20 metres high.



The main **dune ridges**, also known as Yellow or Mobile Dunes, lie further inland and are taller and older than the fore dunes. Behind is a **back slope** where wind speed is much lower and sand is deposited. In

an active sand dune system the dune ridges migrate away from the shore over time.



Between the sand ridges are low hollows, where the sand has been blown away. Only dry sand can be blown, so once wet sand is reached (at the water table), then the process stops. These hollows, called **dune slacks**, are

mostly oriented west to east. Other slacks can be formed along the shore by the build-up of sand on the beach.



The **older dune ridges** or Semi-Fixed Dunes further east are lower and are now fixed by a 'dune scrub' vegetation and may be known as Grey Dunes. Once they are fully vegetated sand movement ceases.

Cumbria GeoConservation is a voluntary group working to record and protect important Local Geological Sites (LGS), formerly Regionally Important Geological and Geomorphological Sites (RIGS). It is a specialist group of **Cumbria Wildlife Trust**. There are 280 LGS in the whole of Cumbria. Other LGS in the Barrow area include *Walney Cliffs*, *Hawcoat Quarry* and *Dunnerholme Point*.

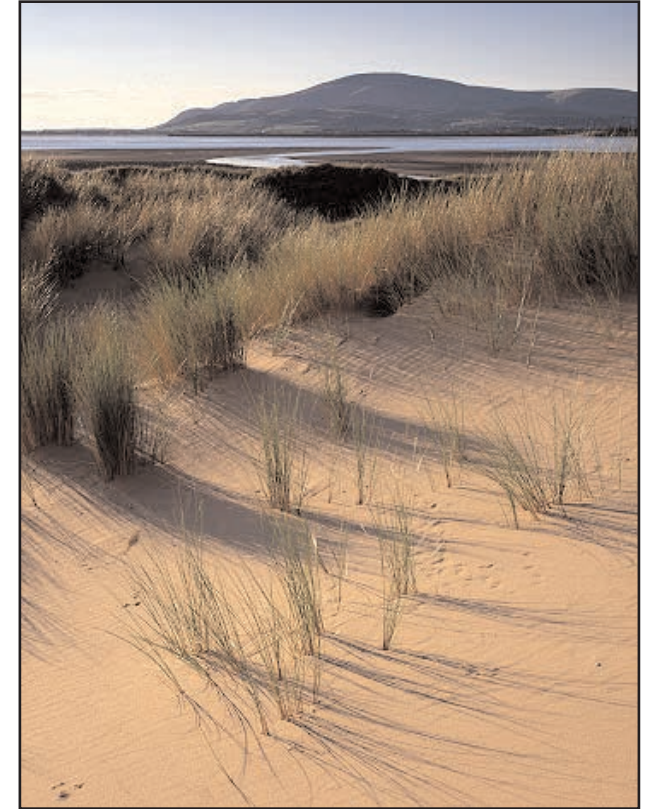


Sandscale Haws sand dunes have national and international conservation importance. The area is a National Nature Reserve (NNR), a Site of Special Scientific Interest (SSSI), part of the Morecambe Bay and Duddon estuary Special Area of Conservation (SPA), Special Area of Protection (SPA) and Ramsar site. It is also a **Local Geological Site LGS 6/005**.

The name 'Sandscale' comes from Scandinavian words, *Sandur* for beach and *Skali* for hut. *Haws* is a Norse word for hills. *Slakki* is a Norse word for a depression.

SANDSCALE HAWS

A PRESENT DAY SAND DUNE SYSTEM



Walk details

Park at: National Trust car park at SD 200756

Map: Ordnance Survey OL6

Time: 2 hours

Surface: This walk is along the beach, on shingle, sand, and sand dunes

Route and text: Sylvia Woodhead

Photos: [c] National Trust / Neil Forbes

Design: John Shippen

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Sandscale Haws sand dune system lies in the **Duddon estuary**. Boreholes have shown that the Carboniferous limestone bedrock is 60 metres down, beneath glacial drift, which consists of till (unsorted material carried by the glacier and dumped as it melted) and water sorted sands, gravels and clays. As the ice melted after the last Ice Age, around 9-8000 years ago, the sea level would have risen rapidly and around 4000 years ago was higher than it is now.

An **abandoned cliff** at the eastern side of Sandscale Haws shows evidence of this higher sea level. Later the waves washed up ridges of shingle, and sand. At times the sea level fell slightly and primitive soils, or palaeosols, formed. Late Neolithic and Bronze Age implements have been found in this ancient soil, which has now been **covered by the blown sand** that now makes up Sandscale Haws.

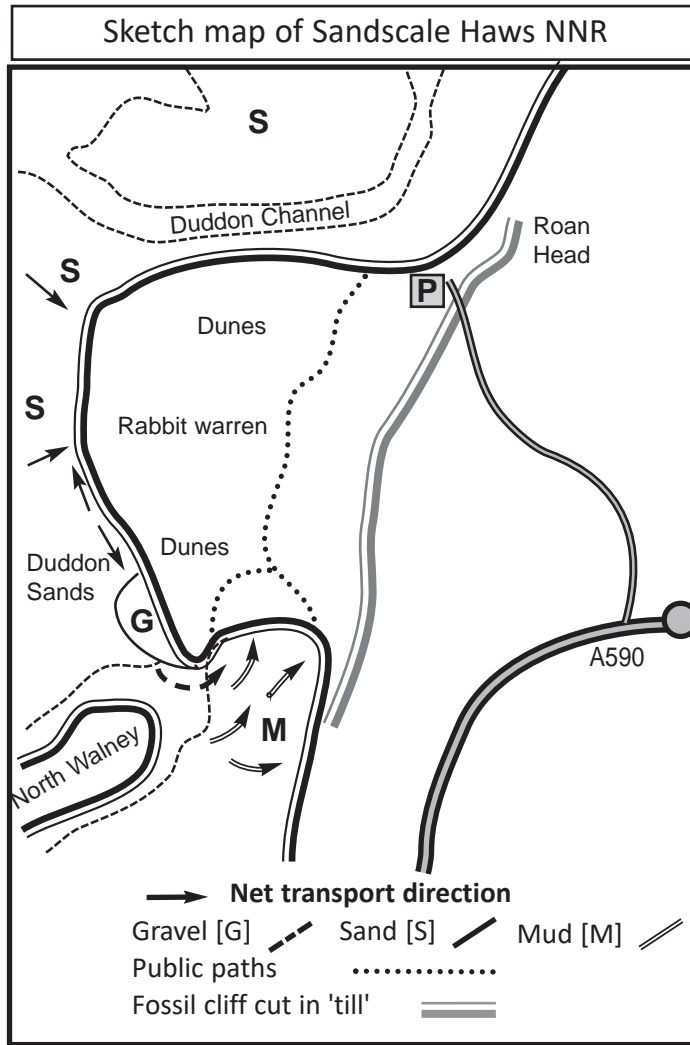


The dunes have formed from dry sand which is blown inland by the prevailing south westerly winds, from the sand banks in the estuary and from the **beach** at low tide.

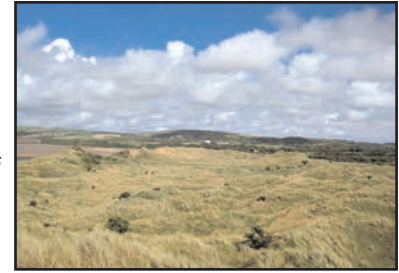
Different parts of Sandscale Haws experience erosion and deposition. Most bare sand and moving sand is limited to the outer edges of the Haws. Erosion of the dunes can reveal old underlying **shingle ridges**, while storm surge events, such as in 1987, can create a new shingle ridge. During very high tides gravel is exposed as the sand on the beach is removed by storm waves. During 'fair weather' typically in summer, the beach recovers and the sand builds up again.



Small sand dunes or **embryo dunes**, can develop at the top of the beach in a dry summer, if wind-blown sand is trapped by debris at the strand line, above high water mark.



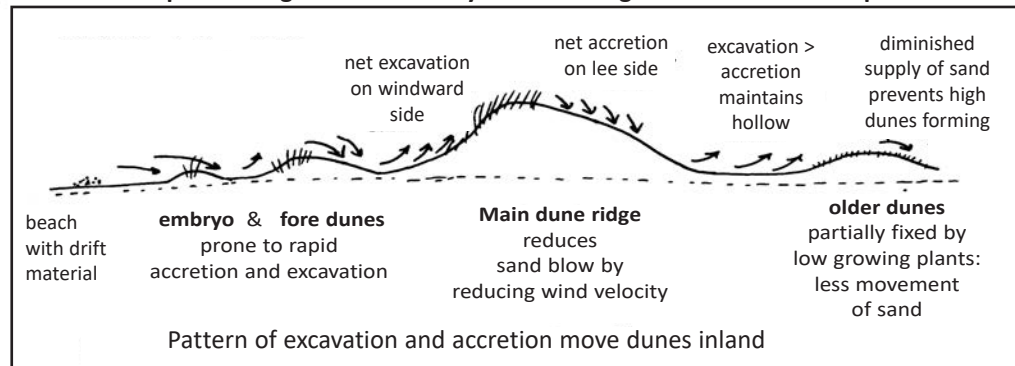
Behind the embryo dunes sand deposition has formed five **main dune ridges**, the highest nearest the sea. The dune system depends on the amount of sand available, wind speeds and coastal exposure. Changes also relate to the channels in the Duddon estuary. As the sand supply is derived from glacial deposits, the amount of sand in the system is essentially fixed. Surprisingly wind speeds have fallen since 1992, leading to decreased sand movement.



In some places the wind has created a **blow out**, or gap in the main dune ridge. The wind excavates the sand down to the water table and leaves a hollow. One significant blow out formed in the 1980s and was enlarged by erosion in 1990.

Sandscale Haws changes over time. Sand was actually removed by 'sand mining' up to about 1954. There was a lot more **bare sand** in the past. Aerial photographs, taken in 1946, 1960 and 1980 show this. Bare sand across the dunes has decreased from 34% to around 2.5% at present, possibly as a result of wetter summers providing less opportunity for sand to blow. There has been less sand movement since about 1960. The dunes build up in some areas, but are currently experiencing significant net erosion at the coast.

Idealized profile diagram of a dune system showing sand erosion and deposition



Recently formed dune slack