

Studland Bay – Coursework Pack



Studland Bay is a very popular site for students completing their GCSE and A-level coursework. We have designed this pack to include background information and answers to common questions that we have received from students over the years. We hope this will help you with your studies, however if you require further information please do not hesitate to get in touch with us:

studlandbay@nationaltrust.org.uk

Contents:

Social-economic background	1
Coastal change	2
Coastal managment	7
Dune-heath ecology	10



Living Coast
Purbeck



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Studland Bay is highly renowned for its ecological and conservation value. It has a high biodiversity with many nationally rare species such as smooth snake, Dartford warbler and heath tiger beetle. The area is designated as both a Site of Special Scientific Interest (SSSI) and a National Nature Reserve (NNR) so is protected by law. **It is also an important place for people** with around 1.5 million visitors each year. People come to enjoy the natural beauty of the area or simply to relax on the beach. Dog walking, horse riding, kayaking, cycling and sailing are all popular activities at Studland. Studland village itself has a rich cultural heritage and a population of just over 400 people. The area is also well known for its history as a training ground for troops in the months leading up to D-Day.

The National Trust manages Studland Bay so that there is a balance between the conservation of its landscape and habitats, the aspirations of the local community, and the demands of tourism and recreational use at the site.

Frequently asked questions:

How many people visit Studland Beach?

Around **1.5 million per year** (weather depending!). July and August are busiest although visitor numbers out of peak season are increasing. Per day the average number of visitors is 25,000 in high season and 1000 in low season.

What are the main visitor impacts?

The large number of visitors that come to Studland each year and support the National Trust enables us to look after special places like this. **Tourism is also a very important source of income to the local economy across Purbeck as a whole.** A study from 2014 estimated that tourists spend £221 million a year in Purbeck and support 25% of employment (~6000 jobs). The impacts arising from the popularity of Studland however include **trampling, littering, disturbance to wildlife, heathland fires caused by careless BBQ's, and traffic congestion.**

Balancing the needs of visitors whilst prioritising conservation of the site can cause areas of conflict. Different user groups have different needs and want to enjoy different parts of the natural environment. The National Trust provides advice and information so that visitors can take personal responsibility to ensure that their actions do not have a negative impact on the enjoyment of others. This is backed up by a zoning system which identifies which activities can be carried out in

which areas. For example: there is a safe swimming area, a dog exclusion zone and a designated naturist area.

When did the National Trust start managing Studland?

The property was donated from the Bankes family in 1982.

How many car parking spaces are there at Studland?

There are 1720 in total across the whole site (Knoll Beach, Middle Beach, South Beach and Shell Bay), and 500 additional overflow spaces.

How are footpaths managed?

The footpaths are managed so that they are safe and comfortable to walk on and that they don't become eroded. In soft areas like the sand dunes or in boggy areas like some parts of the heath we use board walks so that people can walk on a firm surface without causing erosion to the ground. Where paths go along slopes, we dig drainage channels to prevent rainwater flowing down the paths and causing them to become rutted; or install stone steps. If a section of path becomes very badly worn out we will sometimes make an alternative route so that the worn area can recover naturally. On the cliffs that we manage nearby to Studland, we monitor the coast path carefully for any erosion risk and if necessary will realign the path inland.

Useful links:

http://www.bbc.co.uk/schools/gcsebitesize/geography/coasts/coastal_management_rev4.shtml

<https://www.dorsets.co.uk/purbeck>

Coastal Change

The Studland Peninsula is a very dynamic environment, and the morphology of the beach is constantly changing.

During a windy winter stroll along the beach the aftermath of a large storm can look very extreme. However, repeat that same walk during the summer months and you'll often find that much of the sand has been replenished during periods of calmer weather (figure 1). This means although **we can lose several metres of beach overnight** at Studland, over the course of a year the **average rate of recession is 60 cm** (Shoreline Management Plan 2, 2011 <http://www.twobays.net/smp2.htm>).

Climate change means that we are likely to experience more regular large storms. If the time between these extreme events is too short then the beach is not always able to fully recover. Combined with the added pressure of sea-level rise, **this is likely to increase the average rate of change that we experience.**



Figure 1: During the summer the dunes at Knoll beach take on a smoother convex shape as sand accumulates during calm weather (left) When these dunes are eroded during storms, they take on a steeper concave shape (right) also known as 'cliffing'. Images: Doug Whyte

We know that in some places (near the training bank, for example) the beach is accreting at a rate of about 1 m per year; however as a whole the system is losing sediment.

As with any sand spit, the three dominant interacting forces driving change at Studland are waves, tides and winds. These interact to create a number of currents and transport mechanisms that act to move sediment around the beach and wider Bay area. Figure 2 below shows these mechanisms at Studland.

The yellow arrows represent littoral drift, otherwise known as **longshore drift**. This occurs because the waves hit the shore at an angle determined by the direction of the prevailing wind. This acts to push sediment northwards along the beach, resulting in higher rates of accretion in the north and more erosion in the south. Depending on weather conditions waves can also approach parallel to the shore and push sediment up or down the beach. This is called **swash-aligned movement** or wave-driven transport, and is represented by the blue arrows.

Over centuries longshore drift has been the predominant driver that has created the shape of the spit; but the seasonal fluctuations in erosion and accretion that we notice are driven by swash-aligned movement.

Strong **tidal currents** from Poole Harbour (red arrows) deliver considerable quantities of sediment to offshore sources such as Hook Sands, some of which is then driven **onshore** depending on wave conditions. Some sediment is also supplied to the beach from **cliff and dune erosion** (orange arrows). Finally, the green arrows represent **Aeolian (wind-driven) transport**, which shapes the dunes. More information can be found in the SCOPAC Sediment Transport Study (<http://www.scopac.org.uk/sts-2012.html>).

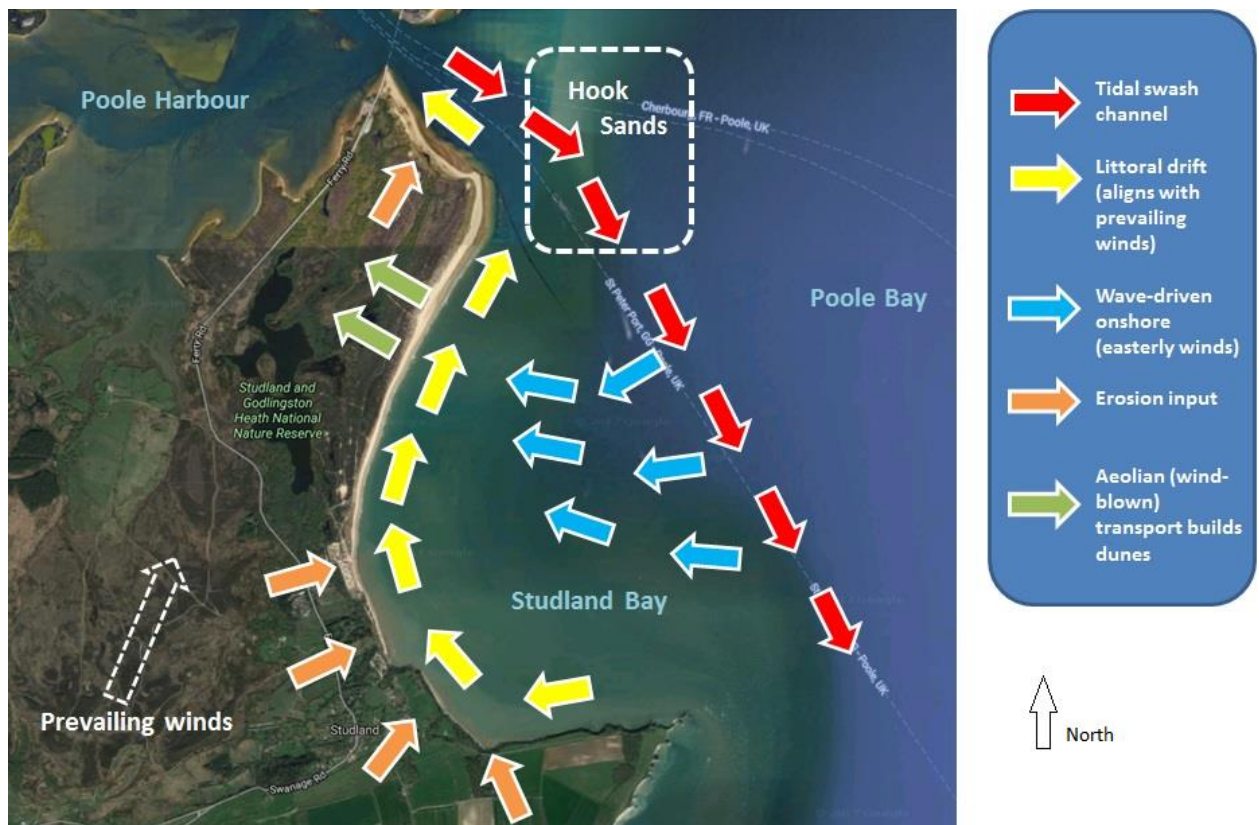


Figure 2: Sediment Transport in Studland Bay, based on the SCOPAC Sediment Transport Study (2004). Aerial photo: Google Earth (2017) Image: Sarah Coggins

Frequently asked questions:

What is the current rate of sea level rise?

Sea-level rise in the south west of England is currently occurring at a rate of **3.5 millimetres per year**; although this rate is expected to accelerate to 8 mm per year by 2055. Locally, estimates from the University of Southampton (2019) indicate the rate might be slightly lower in Poole Bay and Poole Harbour.

How does the erosion rate differ across Studland Bay?

Generally, erosion is greatest in the south and decreases as you go north towards Shell Bay, where the dunes are accreting. The baseline (average) rate is 0.6 m of erosion per year across the whole beach frontage.

Do you have any old maps and photographs of Studland Bay?

Here is a link to a map of Studland from 1585: <http://www.southampton.ac.uk/~imw/jpg-Sandbanks/7SB-Sandbanks-1585.jpg>. You can see on this map that Little Sea hasn't yet been enclosed by the dunes so is still open sea. The formation of the peninsula can be seen in the image below:

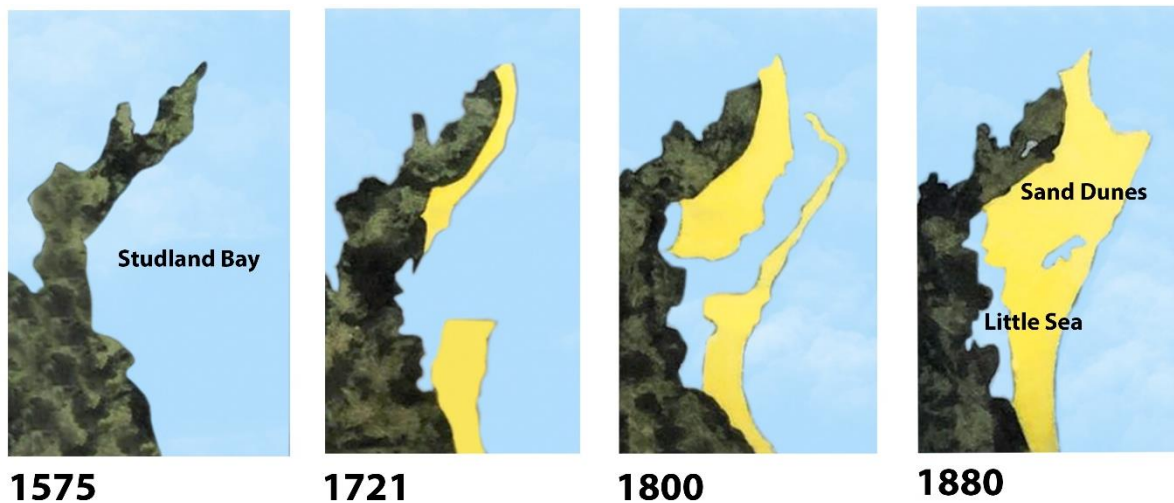


Figure 3: Formation of the Studland Peninsula. Image: Dynamic Dunescapes 2020

If your school has access to it, Digimap is really good for present day maps and has a section for historical maps too: <https://digimap.edina.ac.uk/>.

Figures 4A and 4B show Middle Beach in the early 1900s compared with today. This shows how much the beach here has narrowed at this end of the bay. **The Studland Peninsula is only about 500 years old which is very young in geological terms;** particularly compared to the nearby Jurassic Coast World Heritage Site!



(A)



(B)

Figure 4: Comparison of Middle Beach in the early 1900s with today. Images: Tony Freer (top) Sarah Coggins (bottom)

How is the Studland Peninsula likely to change in the future?

It is likely that the patterns described above will continue over the next few years. However over longer **timescales it is likely that the dunes will start to migrate inland due to sea-level rise**. If, as predicted, climate change means that we will experience more regular large storms, the time between these extreme events may be so short that the beach is not able to fully recover. Combined with the added pressure of sea-level rise, **this is likely to increase the average rate of change that we experience.**



Coastal management policy

Our Coastal Management Policy sets out **how we plan to create a sustainable future for the 24 kilometres of the Purbeck coastline that we care for**. Climate change will put increasing pressures on the coastline: sea-level rise and more frequent storms are likely to increase the rate of coastal change that we experience.

The Isle of Purbeck has an incredibly varied coastal landscape, including beaches, limestone cliffs, lowland heath and chalk grasslands. Each area will respond differently to climate change. This is why we have developed a management policy which takes into account their different characteristics, how they are used by local communities and visitors, and what natural value exists which we need to protect.

We last reviewed our coastal management policy in February 2020. The Purbeck Coast is divided up into **ten different management areas**. We make our plans over three time periods: short-term (up to 2025); medium-term (up to 2055); and long-term (up to 2105). During each time period we decide which broad management policy will guide the decisions we make for that place. These three broad policies are:

No Active Intervention – allowing nature to take its course either on undefended coast or by the removal of current defences.

Managed Realignment – allowing the shoreline to retreat or advance in a controlled and managed way.

Hold The Line – hold the current position by defending whatever is at risk.

Along our **hard rock coast** the rate of coastal change is very slow. We allow nature to take its course in these areas, and will only intervene to manage any safety issues. Cliff slumping could become more frequent due to more regular fluctuations between periods of drought and heavy rainfall.

Our **saltmarshes and mudflats** are particularly vulnerable to **coastal squeeze – when habitats become trapped between rising sea-levels and a fixed landward boundary**. We can help reduce the impacts of this by removing hard boundaries at the coast wherever possible and identifying suitable areas of our land that could be used to allow these habitats to migrate to new areas.

Along a majority of our **beaches** we plan to let nature take its course. This is because dunes are naturally dynamic habitats that are far more able to recover from the pressures of storms and sea-level rise if sediment can move freely around the system. We will remove existing defences when they reach the end of their working life and make plans to gradually roll back any vulnerable facilities along the coast.

Shifting Shores

Coastal management in Purbeck has been guided by our ‘Shifting Shores’ policy, as well as the local Shoreline Management Plan. Launched in 2005, **the aim of ‘Shifting Shores’ was to encourage coastal National Trust properties to develop long-term plans for their coast**, by identifying and putting in place ways to adapt to the increasing pressures of climate change.

A key part of this is **to work with nature wherever possible** in order to create a healthier, more natural environment that can be enjoyed by everyone for years to come.

Useful links:

- Find out more about Shifting Shores <https://www.nationaltrust.org.uk/features/living-with-change-our-shifting-shores>
- Find out more about the Middle Beach Project: <https://www.nationaltrust.org.uk/studland-bay/features/shifting-shores-at-middle-beach>
- Find out more about the policy at each of sites in Purbeck, including Knoll Beach and Shell Bay: <https://ntpurbeckcoast.wordpress.com/looking-after-our-coast/>
- Read the full Coastal Management Policy: <https://ntpurbeckcoast.files.wordpress.com/2020/02/coastal-management-policy-in-purbeck-february-2020-final.pdf>
- Changing Coasts – A Tremendous Tale <https://www.youtube.com/watch?v=i-tPOlMeWbl>
- You can also email Sarah Coggins, Coastal Change Engagement Officer: sarah.coggins@nationaltrust.org.uk

Frequently asked questions:

Why doesn't the National Trust defend the beaches at Studland?

Our coastal policy for a majority Studland Bay is to work with natural processes wherever possible. This is because dunes are naturally dynamic habitats that are far more able to recover from the pressures of storms and sea-level rise if sand is able to move freely around the system.

Hard defences such as groynes and rock armour prevent this from happening and can actually do more harm than good over the long-term. Working with natural processes will maintain a beach here for as long as possible. We are also making plans to gradually roll back the visitor facilities to ensure that everyone can continue to access and enjoy the Studland Peninsula.

Has the National Trust policy benefitted social, economic or environmental factors the most and why?

One of our major priorities at Studland is **conservation of the incredible environment we have here and managing access to it so that it can be enjoyed by everyone**. It is critical that we do everything we can to maintain and increase the health of this rich ecological landscape.

Defences alter the natural sediment dynamics that have created this habitat and diminish the environmental value of the beach through beach lowering. Our coastal policy helps us to manage access to Studland by allowing us to maintain beach infrastructure for as long as possible whilst simultaneously developing innovative ways to move assets out of harm's way. Furthermore, removing defences can release a source of sediment from the cliff that allows the beach to build up material. **We work actively with local communities through this process** to try and minimise the negative impacts of coastal change.

Do you believe that the National Trust policy is a sustainable way of managing the beach?

Sustainability is at the core of our coastal policy. Sea-level rise and increased storminess attributed to climate change will put increasing pressures on our coastline. All around the 775 miles of coastline under our care, the National Trust recognises that in order to reduce the negative impacts of climate change we need to break the cycle of 'build-repair-re-build' and look towards innovative ways in which we can adapt to living with a changing coast. It is clear that sea defences should only be used to buy time in order to develop more long-term and sustainable approaches.

Does the National Trust manage Swanage Beach?

The National Trust doesn't manage Swanage Beach; however a good place to start for information would be the local Shoreline Management Plan. This will tell you the average erosion rate on Swanage Beach, and what the plans are to manage it over the next century <http://www.twobays.net/SMP2%20Final/Main%20Report/Section%204%20-%204.5%20PDZ4.pdf>

We do manage the cliffs on the eastern side of Swanage Beach around to Old Harry Rocks. We have a policy of no active intervention here meaning we will allow the cliffs to gradually erode and will ensure that there is safe access to the coastal path.

Does the National Trust manage seaweed at the site?

Seaweed is an important part of a natural coastal ecosystem - it is a rich wildlife habitat and nourishes the pioneer plants during sand dune formation. **Therefore our policy is to leave seaweed in place and not to rake the beach.** However, there are circumstances where a build-up of large amounts of seaweed, especially after onshore gales, can become smelly, slippery and reduce the enjoyment of visitors to the beach. In these circumstances the seaweed is removed from the beach by tractor. This happens on average 3 or 4 times a year.



With more than 75 hectares, Studland is the largest area of dune heath on the South Coast.

Dunes are formed as wind blows sand up from the beach into mounds and ridges (aeolian transport). They continue to blow around until they are stabilised by the dune specialist marram grass. The Studland dunes themselves are unusual, because they are made of **acidic sand with very low shell content**.

This acidity means that after about 60 years, when the roots of the marram grass have anchored the sand in place, they become colonised by heather. **Subsequently most of the Studland dune system is characterised by an unusual habitat known as dune heath.**

As well as the marram, the younger dunes are home to an **array of wildflowers** throughout the summer, including powder blue sheep's bit and the golden yellow cat's ear. Look closely and you will find much rarer plants as well, including the red data book listed sea stock, or the seashore specialist prickly saltwort.

Further inland and into the heather, the dune heath has fewer wildflowers, but it is home to particularly **important lichen and fungi communities**.

The dune heath is also home to **all six native reptiles, birds including breeding nightjar and Dartford warbler**, and many **specialist invertebrates** that thrive on the many sunspots on the south-facing slopes.

Difficult terrain means that we rely on **grazing animals to keep the heath from turning to scrub and woodland**. Rabbits and deer both play their part, but our Red Devon cattle are probably our single most important management tool for keeping the vegetation in check. As part of the **Dynamic Dunescapes Project**, Devon cattle will graze the heath behind the beach from June 2021.

Useful links:

<https://www.nationaltrust.org.uk/studland-bay/features/studlands-sand-dunes>

<https://dynamicdunescape.co.uk/project/dorset/>

<https://www.ceh.ac.uk/our-science/projects/sand-dunes>

Frequently asked questions:

What are the key plant species on the dunes?

The key plant species for development of the sand dunes are **marram grass, lyme grass, sand sedge, sea rocket and prickly saltwort**. Other species that can be seen there are common centaury, sheep's-bit scabious, sea bindweed and occasional bee orchids.

What are the key reptile species on the dunes?

The dune heath is also home to **all six native reptiles: adder, smooth snake, grass snake, slow worm, sand lizard, and common lizard**.

Sand lizards are one of the UK's rarest reptiles but they thrive at Studland. The sand dunes here provide the perfect habitat because there is plenty of food (especially spiders), sand banks to burrow into for egg laying, and south facing slopes for basking.

The main management for sand lizards here is to maintain an open habitat rather than let it develop into scrub or woodland. In the winter, rangers and volunteers cut back excessive growth of gorse and cut down pine or birch trees that are spreading into the heathland. This seems contradictory on a nature reserve but if this work did not continue, over time the heather would gradually be shaded out by taller vegetation.

Sand lizards are fairly common and widespread over the heath, favouring south facing, sandy banks. Surprisingly, the area around the Knoll Beach huts and the Discovery Centre is very good for spotting sand lizards even though it can be quite busy with people. I think the lizards here are more tolerant of disturbance and tend to remain in view even when people approach them

How does the National Trust manage the impacts that tourists have on the sand dunes?

Trampling that is too concentrated is a concern at Studland due to our high visitor numbers. Trampling can damage the plants that bind the dunes together which acts to increase the erosion rate. This has to be managed because the dunes are an important wildlife habitat, add to the landscape quality of the beach and act as a natural sea defence.

Protection involves simply placing some sort of barrier around the dunes together with signs that ask people to avoid walking over these areas. A basic post and rope fence is usually enough to achieve this as people are generally respectful of what the National Trust are trying to do. In some cases **vegetation such as marram grass can be transplanted from other areas**. Also, where there are paths through the dunes, a **wooden board walk can be laid over the sand to reduce trampling**. **Some trampling however can be highly beneficial to the management of the dunes.** The Dynamic

Dunescapes Project is actively encouraging people to explore the dunes in areas where we want to create more bare sandy habitats.

How will the Dynamic Dunescapes project affect coastal erosion? The Dunescapes project aims to increase bare sandy habitats and create a dynamic ecosystem, will this not also increase erosion?

Trampling does lead to localised erosion and this can be damaging if it is not managed correctly or is too focused in one spot. However, with such careful management as in Dynamic Dunescapes, and over such a large area, the effects will only be beneficial. **Mobilising the dunes allows them to respond to sea-level rise and storm events by allowing sediment to move freely around the system.**

If a fixed dune gets hit by an extreme tide then it will be washed away and might not recover, whereas one that is mobile can roll back and then sediment can be redeposited when the sea-level drops. So, whilst it will not stop coastal erosion from occurring over the long term, it makes the coastline more resilient by allowing natural processes to occur.

How much have the dunes retreated?

This varies along the beach: **New dunes are being formed by Pilot Point**, and where there is rapid accretion some of these dunes have been colonised by marram grass. Many of the dunes undergo shelving towards Knoll and Middle Beach. Some of this sediment is redeposited.

The rate of erosion becomes greatest towards the south end of the dune system. The average retreat is **0.6 m per year**, but dunes shift rapidly with several metres being lost during one storm event.

How does pH vary along the sand dune profile?

pH ranges from **4.5** on the lee of the first dune to **3.5** as you get towards the scrub on the 4th ridge. This means that the dunes at Studland are acidic enough that once marram grass has stabilised then heather can grow relatively quickly compared to other dune sites.

What are the impacts of heathland fires and how do we manage the risk?

Heathland fires are a constant cause of concern for the countryside staff here at Studland because of the large numbers of recreational users and the potential for extensive damage from a discarded cigarette or if a barbeque or camp fire becomes out of control. Also there is the possibility of arsonists starting fires deliberately. **Fires are potentially very damaging to the dunes as they destroy the vegetation (principally marram grass and heather) that hold the sand together and keep the dune stable.** Without the vegetation, dunes can be eroded by strong winds or trampling by walkers. Fortunately there have been only small fires in recent years, averaging around three or four per year.

Our preventative measures include informing visitors of the potential risks through signs, information leaflets, and personal contact through staff out on patrol. **Open fires are not allowed on the site** but there are six designated BBQ areas along the beach.

Is the marine environment Studland high in biodiversity?

Yes! Two main features of the marine environment are the **strandline** and the **eel grass meadows**.

The strandline is where detached seaweed - such as sea lettuce, serrated wrack and kelp - accumulates on the beach. This is an important habitat for flies and sandhoppers which in turn are a food source for wading birds such as Turnstones, Ringed Plovers and Sanderlings. Along the beach at low tide you can see the casts of lugworms and the cases of sand mason worms along with a wide range of mollusc shells (mostly empty) washed up by waves and tides. The commonest shells are slipper limpets, cockles, razorshells, trough shells, netted dog whelks and saddle oysters.

The eel grass meadows are an incredibly important environment and are the main reason that **Studland Bay became a designated Marine Conservation Zone (MCZ) in 2019**. They provide a nursery for many species of commercial fish and are also home to seahorses (both spiny and short-snouted). Seagrasses such as eel grass also play an important role in coastal protection by buffering the impact of waves. **Seagrasses can also help fight climate change** – they remove carbon dioxide from the atmosphere 35 times more effectively than a tropical rainforest!

How has the sand dune profile changed as a result of the National Trust's coastal management policy?

Protecting and conserving the dunes is a high priority for the National Trust because of their landscape value, their importance as a wildlife habitat with rare or unusual species and their role as a natural defence against rising sea levels. Our policy is to allow a majority of the beach frontage to develop naturally. This is because allowing the beach to reach a natural alignment is the most sustainable management option, and will **increase the resilience of the dune-heath system to the impacts of climate change**. Because we allow the dunes to develop naturally, they can be more dynamic and accrete where there is sufficient sediment supply.

Useful links:

Find out more about the Dynamic Dunes Project:

<https://ntpurbcoast.wordpress.com/dynamicdunes/>