

3.1 The Coastal system

Systems terminology helps us to understand the connections between processes and landforms

Input	Material or energy moving into the system from outside	e.g. precipitation, wind
Output	Material or energy moving from the system to outside	e.g. ocean currents, rip tides, sediment transfer, evaporation
Energy	Power or driving force	e.g. energy associated with flowing water, the effects of gravity on moving cliffs
Stores / components	The individual elements or parts of a system	e.g. beach, sand dunes
Flows / transfers	The links or relationships between components	e.g. wind-blown sand, longshore drift, mass movement
Positive feedback	Where a flow/transfer leads to increase or growth	e.g. coastal management can lead to an increase in erosion elsewhere along the coast
Negative feedback	Where a flow/transfer leads to a decrease or decline	e.g. when the rate of weathering and mass movement exceeds the rate of cliff-foot erosion
Dynamic equilibrium	A state of balance within a constantly changing system	e.g. constructive waves build up a beach, making it steeper. This encourages the formation of destructive waves that plunge redistributing the sediment.

3.5.1 Erosion

The break down and transport of rocks – smooth, round and sorted.

Attrition	Rocks that bash together to become smooth/smaller.
Corrosion	A chemical reaction that dissolved rocks.
Corrasion	Rocks hurled at the base of a cliff to break pieces apart.
Hydraulic Action	Water enters cracks in the cliff, air compresses, causing the crack to expand.

Hydraulic action: Waves crash against the coast, forcing air into cracks and breaking up the rock.

Attrition: Pebbles picked up by the waves, bash into each other, wearing down into smaller, rounder particles.

Abrasion: Waves pick up rocks from the seabed and smash them against the coast, wearing it away.

Solution: Rocks like limestone slowly dissolve in the water.

3.5.2 Transportation

A natural process by which eroded material is carried/transported.

Solution	Minerals dissolve in water and are carried along.
Suspension	Sediment is carried along in the flow of the water.
Saltation	Pebbles that bounce along the sea/river bed.
Traction	Boulders that roll along a river/sea bed by the force of the flowing water.

3.2.1 How are waves formed?

The formation, size and shape is a result of the exchange of energy from wind blowing over the sea.



3.2.2 Different types of waves

There are two main types of wave: **constructive** and **destructive**

Formation	Distant weather systems in the open ocean	Local storms
Wave form	Low, surging. Long wavelength	High, plunging. Short wavelength
Wave break	String swash, weak backwash	Weak swash, strong backwash
Beach	Beach gain. Gentle profile	Beach loss. Steeper profile

Coastal systems and landscapes

Unit 1, Section B, Topic 3

3.3 Sediment sources, cells and budgets

Rivers are the main source of coastal sediment. Other sources include cliff erosion and offshore marine erosion

Sediment cells

- Largely self contained natural systems
- Usually found between two headlands
- The movement of sediment is pretty much contained

Inputs (sources)

- River and coastal erosion

Transfers

- Longshore drift
- Rip currents

Stores (sinks)

- Beaches
- Sand dunes
- Bars

Sediment budgets

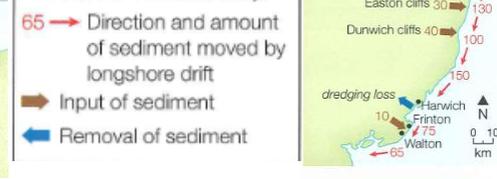
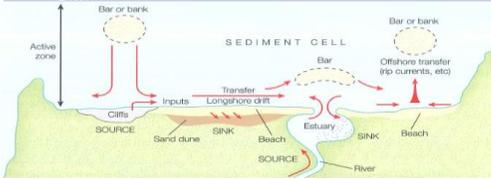
- The total sediment in a sediment cell

Losses

- Deposition into sediment sinks

Gains

- Coastal erosion
- Sediment brought into the system by rivers or other offshore sources.



3.5.3 Deposition

When the water loses energy transported sediment is dropped.

3.4.1 Weathering

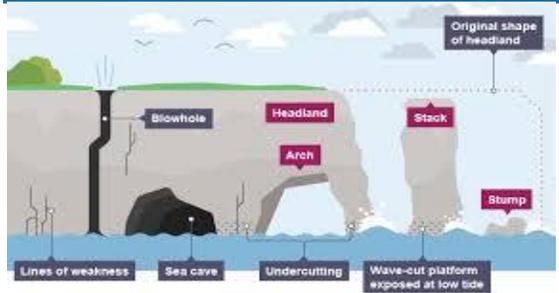
The breakdown or decay of rocks.

Mechanical	The break-up of rocks without any chemical changes e.g. frost shattering, salt crystallisation, wetting and drying.
Chemical	A chemical reaction e.g. carbonation, oxidation and solution.
Biological	The breakdown of rocks by organic activity e.g. plant roots, burrowing animals and birds.

3.4.2 Mass movement

The downhill movement of material under the influence of gravity. This can be classified into creep, flow, slide and fall.

3.6.1 Landforms of erosion: cave, arch, stack, stump



- 1) Hydraulic action widens cracks in the cliff face over time.
- 2) Abrasion forms a wave cut notch between HT and LT.
- 3) Further abrasion widens the wave cut notch to form a cave.
- 4) Caves from both sides of the headland break through to form an arch.
- 5) Weather above/erosion below –arch collapses leaving stack.
- 6) Further weathering and erosion leaves a stump.

3.9 Coastal management

Hard Engineering Defences

Groynes	Wood barriers prevent longshore drift, so the beach can build up.	<ul style="list-style-type: none"> ✓ Beach still accessible. ✗ No deposition further down coast = erodes faster.
Sea Walls	Concrete walls break up the energy of the wave. Has a lip to stop waves going over.	<ul style="list-style-type: none"> ✓ Long life span ✓ Protects from flooding ✗ Reflects energy rather than absorbing it.
Rip Rap/rock armour	Cages of rocks/boulders absorb the waves energy, protecting the cliff behind.	<ul style="list-style-type: none"> ✓ Cheap ✓ Local material can be used to look less strange. ✗ Intrusive and does not fit in with the local geology.

Soft Engineering Defences

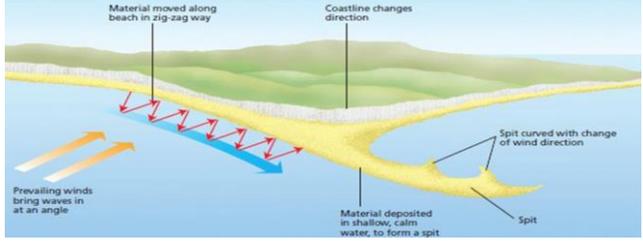
Beach Nourishment	Beaches built up with sand, so waves have to travel further before eroding cliffs.	<ul style="list-style-type: none"> ✓ Cheap ✓ Beach for tourists. ✗ Storms = need replacing. ✗ Offshore dredging damages seabed.
Marsh creation	Low value areas of the coast are left to flood and erode naturally.	<ul style="list-style-type: none"> ✓ Reduce flood risk ✓ Creates wildlife habitats. ✗ Compensation for land.

3.6.2 Landforms of erosion: Headlands and bays



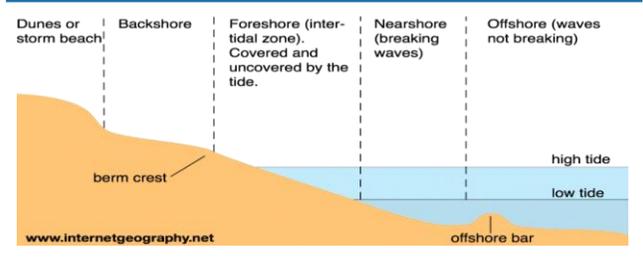
- 1) Waves attack the coastline.
- 2) Softer rock is eroded by the sea quicker forming a bay, calm area cases deposition.
- 3) More resistant rock is left jutting out into the sea. This is a headland and is now more vulnerable to erosion.

3.7.1 Landforms of deposition: Spit

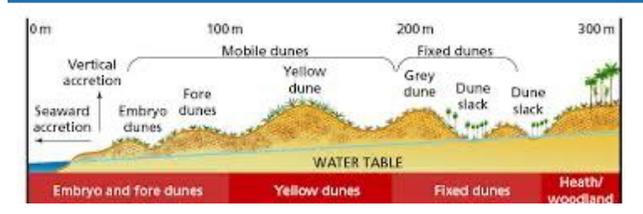


- 1) Swash moves up the beach at the angle of the prevailing wind.
- 2) Backwash moves down the beach at 90° to coastline, due to gravity.
- 3) Zigzag movement (Longshore Drift) transports material along beach.
- 4) Deposition causes beach to extend, until reaching a river estuary.
- 5) Change in prevailing wind direction forms a hook.
- 6) Sheltered area behind spit encourages deposition, salt marsh forms.

3.7.2 Landforms of deposition: Beach



3.7.3 Landforms of deposition: Sand dunes



- 1) Large quantities of sand from constructive waves
- 2) Large tidal range, creating a large exposure of sand that can dry out at low tide
- 3) Dominant onshore winds, to blow dried sand to the back of the beach.

3.8.1 Sea level change

Sea levels respond to climate change, in particular the onset of glacial and interglacial periods.

Eustatic change	Isostatic change
- Changes in sea level (rise or fall)	- The land itself changes in height, relative to the sea

3.8.2 Landforms: caused by changing sea level

Emergent coastline	Submergent coastline
- A fall in sea level exposes land previously covered by the sea.	- A rise in sea level floods the coast.

Raised beaches

When wave-cut platforms and their beaches are raised above the present sea level.

Rias

Sheltered, winding inlets formed when a rise in sea level drowned river valleys

3.8.3 Contemporary sea level change

- Until recently sea levels have been stable for the past 3000 years.
- Over the 20th century global sea levels have rose by 1.7mm per year.
- By 2100 it is estimated that sea levels could have increased by up to 1m.
- This increase is largely due to thermal expansion of water due to warming and the melting of ice.

Fjords

Formed when deep glacial troughs are flooded by a rise in sea level

Dalmatian coasts

Formed when valleys running parallel to the coast are flooded by a rise in sea level.

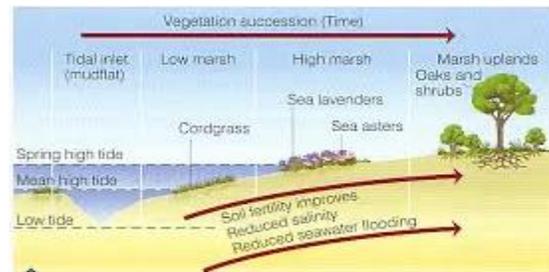
3.7.5 Landforms of deposition: Barrier beach (bars)

Where a beach or spit extends across a bay to join two headlands

3.7.6 Landforms of deposition: Offshore bar

Are submerged or partly exposed ridges of sediment created by offshore waves

3.7.7 Landforms of deposition: Saltmarsh



Develop in three types of environment:

- Sheltered areas where deposition occurs.
- Where salt and freshwater meet.
- Where there are no strong tides or currents to prevent sediment deposition.