

The Severn estuary environment

Specification topic: Estuarine environments

Case study: The Severn Estuary

The Severn Estuary is the largest coastal estuary in the UK and one of the largest in Europe. It is a unique estuarine environment that has formed due to the tidal range it experiences. The Severn has a macro-tidal range, 13 metres in some places. The main reason for these very high tides is due to the variation in funnel shape of the estuary from wide to narrow which forces the incoming tide higher as it travels further inland.

There are several habitats which are found in the estuary.

Firstly, mudflats. Mudflats are deposits of mud, silt and clay found in the sheltered intertidal areas of the estuary. Mudflats are formed by fine silt deposited by the tide and alluvium deposited by the River Severn. Deposition occurs due to the fresh and salt water currents meeting and the energy in both flows reducing, leading to deposition. The process of deposition occurs continually and the mud flats accumulate over time. They range from soft muds in the most sheltered inner areas of the estuary, to firm sands in areas that are exposed to strong waves. The mudflats are submerged by the high tide and fully exposed during low tide. They provide an area of immense nutrition for permanent roosting and wading birds. The large invertebrate population inhabiting the mud also provides an important food supply for migratory birds.

In some areas of the estuary the mudflats are protected from the changing tide and have converted into saltmarshes. The change into saltmarshes is due to vegetation colonising the mudflats. These are vulnerable environments, affected by the dynamic balance between the deposition of river sediments and the potential erosion from the tide. Saltmarshes contribute 4% of the UK's total wildlife habitat so are an important area for conservation. They develop where halophytes (salt tolerant plants) colonise soft intertidal sediments, in areas protected from strong wave action. These plants allow the continued build-up of sediments on the salt marsh and offer refuge above tidal level for many species. There are many fresh water streams which intersect the marsh areas.

Rocky intertidal habitats are found along the shores of the estuary and are composed of rocks, boulders, shingle and mussel scars. This habitat is an extreme habitat due to the exposure to the tidal range, wave action and strong wind. Despite the conditions a large range of species do manage to survive here, including winkles, limpets and algae and, again, these species provide a feeding ground for many wading and migratory birds.

Subtidal sand banks are permanently submerged sand deposits usually at a depth of less than 20 metres. There are many invertebrate communities which exist on the sandbank and it is deemed to be an important food sources for many fish species.

Biogenic reef systems are also found in some areas of the Severn estuary. They are found in both intertidal and subtidal zones of the estuary. There are no other estuaries in the south

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west UK which have reef systems, making the Severn Estuary more significant in terms of conservation. Intertidal reefs can be found at Redcliff Bay near Portishead, south of Severn Beach near Avonmouth and at Goldcliff near Newport. Subtidal reefs occur in large groups throughout the mouth of the estuary.

The range of habitats and the life these habitats support make the River Severn Estuary valuable in terms of its biodiversity. Many of these species are vulnerable to slight changes in salinity of estuarine waters and sea level rise. Potential climate change and resulting sea level rise would be disastrous for many of these habitats as some would face complete submergence and resulting in some species becoming extinct. Climate change is also likely to result in increased storm activity and the impact of regular storm surges funnelling up the estuary could result in increased erosion and removal of sediments which are integral to their formation, particularly of mudflats and salt marshes. Reduced salinity levels of the sea may also occur due to freshwater ice melt and again certain species will die out.

Indirectly, human intervention to prevent coastal damage from increasing sea level could also be detrimental to the habitats. As we build sea walls and other coastal protection methods, many habitats will suffer due to the natural processes impacting upon them being altered. For example, the accumulation of sediments in the estuary could occur too rapidly for some species to cope.

One habitat, however, that may benefit from climate change is the reef system which thrives in warmer waters. The River Severn is currently only just able to support this reef building but with higher ocean temperatures the habitat could grow more rapidly.

Exam style questions:

- 1. Explain the development of a saltmarsh (6 marks)**
- 2. “No amount of coastal intervention can halt the impact of climate change and rising sea levels on vulnerable coastal environments.” To what extent do you agree with this view? (20 marks)**

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1. Explain the development of a saltmarsh (6 marks)

Sequential formation required. Explanation surrounding the role of a river's energy reducing as it nears the sea resulting in deposition of alluvium, together with tidal deposition of sediment. Over time these processes create mudflats. Colonisation by salt-tolerant vegetation will result in salt marsh formation. Explain the succession of a halophytic environment.

2. "No amount of coastal intervention can halt the impact of climate change and rising sea levels on vulnerable coastal environments." To what extent do you agree with this view? (20 marks)

Whilst this question is wide ranging and could use case study material from a range of areas (including coral reef etc.), an ideal case study is an estuarine environment.

The key focus of this question is to show understanding of:

1. Why the estuarine environment is vulnerable - dynamic due to the changing wave and wind energy and tidal range. Many landforms in this environment are subject to daily change (based around soft sediment formation).
2. What rising sea level can do to the environment – increased tide height, salinity changes etc.
3. What coastal intervention can be put in place to protect the environments.
4. How successful will this be – critique the costs and benefits of the methods and discuss how the environment will change or not as a result of the intervention.

Key ideas regarding intervention would be coastal sea walls, although this will do little to prevent impact on the estuary. Estuaries, by their very nature, cannot be blocked off from the sea as the equilibrium of the habitat will break down.

Other suggested intervention is to protect individual landforms with defences. Again, these landforms require further input of sediment and this would not be the case if they were encircled by a hard engineering technique. Closing off the landforms may also prevent wading birds from landing on them so the impact could be negative towards certain species.

A clear understanding of a systems approach to estuary development and maintenance will help convey the fragile balance between inputs, stores, processes and outputs and is required for the top marks.

One successful technique could be soft engineering and stabilisation. Planting vegetation to stabilise the salt marshes may help and allow the estuarine system to adapt to a new dynamic equilibrium of rising sea levels.

An overall evaluation is required whereby the potential costs and benefits are weighed up and a judgement is made regarding how the estuarine environment can or can't be protected from the impacts of climate change and rising sea levels.