Scheme of work: Coastal systems and landscapes

Introduction

This scheme of work offers a route through the AS and A-level Geography (7036 and 7037) specifications with a core focus on Physical Geography, optional topic Coastal systems and landscapes.

It covers the specification in a logical order and suggests possible teaching and learning activities for each section of the specification.

The specification content is shown at the start of each section, some suggested activities will target multiple specification points. The learning outcomes indicate what most students should be able to achieve after the work is completed.

Timings have been suggested but are approximate. Teachers should select activities appropriate to their students and the curriculum time available.

The order is by no means prescriptive and there are many alternative ways in which the content could be organised.

The resources indicate those resources commonly available to schools, and other references that may be helpful. Resources are only given in brief and risk assessments should be carried out.

Resources exemplify case studies in this scheme of work, but that it not an endorsement of these case studies and schools are free to choose case studies that are relevant for their students.

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Contents

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3.1 Physical Geography

Optional topic: 3.1.3 Coastal systems and landscapes

The importance of coasts

Specification content

3.1.3.1 Coasts as natural systems

The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

Learning outcomes

This lesson will help students to understand:

- The importance of coasts in both physical and human environments.
- How coastlines can have many different characteristics that make up the coastal landscape.

Suggested timing

1 hour

Possible teaching and learning activities

- Recap prior learning at KS3 and/or GCSE by asking students to write a list of coastal features and processes. Each students draws a sketch of a coastal landform and annotates to explain how it formed.
- Define 'the coast'. Give students a list of key words to use and they write their own definitions. What are the key characteristics of coastlines?
- Give students random questions about the importance of coasts and ask each student to come up with answers. These can then be read out to the class. Some examples might include: Why do you go to coasts? What economical activities happen at the coast? What features do you like best at the coast and why? How often do you visit the coast? Why do different people visit the coast?
- Find some recent newspaper articles about the coast and make a list of reasons why the coast is important.
- Discuss the range of factors that affect coastal landscapes for example, geology, land-use, vegetation, atmospheric, tectonic etc. Find examples of how these factors impact coastlines.

Resources

- Read the article about the 16 of the world's best coastlines according to CNN. Useful for images and discussion of the importance of the coast.
- Read the information about coastlines and images of global coastal landscapes (National Geographic).

Coastal systems and sediment budgets

Specification content

3.1.3.1 Coasts as natural systems

Systems in physical geography: systems concepts and their application to the development of coastal landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

Links with other units

3.1.1.1 Water and carbon cycles as natural systems

Systems in physical geography: systems concepts and their application to the water and carbon cycles inputs – outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium.

Learning outcomes

This lesson will help students to understand:

- What the coastal system is and how it relates to other Earth systems.
- What the inputs, outputs, stores and flows/transfers of coastal systems are.
- How positive and negative feedback change coastal systems and the concept of dynamic equilibrium.

Suggested timing

1 to 2 hours

Possible teaching and learning activities

- Note: This lesson will depend on units already studied. For example, if Water and carbon cycles have already been taught then there is no need to cover the basics on systems again.
- Students to think of different Earth systems. Recap what they know about systems. Draw a simple systems diagram based on a simple activity such as making a cup of tea – consider the inputs, stores, processes and outputs.
- Give students a list of coastal system key terms and ask them to sort into inputs, stores, processes and outputs. Compare a coastal system to another Earth system for example, Hydrological cycle.
- Consider how coastal systems interact with other Earth systems for example, atmospheric, glacial systems.
- Model examples of positive and negative feedback loops in coastal systems. Ask students to come up with their own examples. Good starting points: increased carbon emissions, increased intensity of storms, rising sea-levels etc.

Resources

- Watch the 10 minute TED talk video focusing on how different systems operate in Florida and how an interdisciplinary approach is needed to ensure the future of coastal systems (YouTube).
- Read the article on an introduction to geographical systems (Geography Education Online).
- Read the National Geographic page on: Hydrosphere.
- Read the National Geographic page on: Lithosphere.
- Read the National Geographic page on: Atmosphere.
- Read the National Geographic page on: Biosphere.
- Read the NOAA Ocean service page What is the cryosphere?

Sources of energy in coastal environments

Specification content

3.1.3.2 Systems and processes

Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts.

Learning outcomes

This lesson will help students to understand:

- The different sources of energy found in coastal environments.
- How wind impacts wave types and coastal processes.
- The differences between constructive and destructive waves.
- The different characteristics of low and high energy coasts.

Suggested timing

2 hours

Possible teaching and learning activities

- Construct a diagram to illustrate the different coastal zones.
- Group discussion to identify sources of energy found at the coast.
- Explore what wind is and the reasons for different wind directions and wind strengths.
- Give students UK maps marked with different stretches of coastline, predict what factors will be impacting wind strength and direction. Discuss how this will affect waves and coastal processes.
- Show video clips of different wave types and ask students to identify factors that will affect them – consider fetch, strength of wind, wind direction etc. Use the information to predict wave characteristics at two contrasting coastlines.
- Investigate how waves are formed – differentiate between ocean waves and tsunami waves.
- Give students unlabelled diagrams of constructive waves and destructive waves and ask them to identify the differences. Add correct terminology by recapping prior knowledge from GCSE geography or science.
- Use an atlas or internet research to produce a map of ocean currents, and annotate to describe and explain the pattern of ocean currents.
- Discuss different types of ocean currents in the coastal zone.
- Construct annotated diagrams to illustrate high and low tides, neap and spring tides and the role of the alignment of the earth, moon and sun.
- Divide the class into groups and ask each group to prepare a short presentation on one source of energy and how it will affect the physical characteristics of the coastline.
- Students can research examples of tidal surges and the impacts on coastlines and their communities.
- Give students statements about high and low energy coastlines and ask them to classify according to whether they are typical of high or low energy coastlines.

- Fieldwork opportunity: visit two different beaches and measures sources of energy such as wave types, wind direction/speed. Observe how these sources of energy are determining the characteristics of the coastline.

Resources

- Watch Fundy Tides and Tales, a 3 minute YouTube video explaining ocean tides in relation to the Bay of Fundy in Nova Scotia.
- Explore the interactive visualiser for ocean currents, waves, winds (Earth.nullschool). The layers are changeable.
- Explore the useful map of ocean currents The Major Ocean Currents of the World (Earth How).
- Read the article Constructive and destructive waves- types of waves made SIMPLE (The Geography teacher).
- Explore the National Network of Regional Coastal Monitoring Programmes *(Coastal Monitoring)* - current wave hight data from around the UK.
- Read the article on ideas for investigating high and low energy coastlines Coasts (for 16-18 Geography) (Field Studies Council).

Sediment cells, sources and budgets

Specification content

3.1.3.1 Coasts as natural systems

Systems in physical geography: systems concepts and their application to the development of coastal landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium.

3.1.3.2 Systems and processes

Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts. Sediment sources, cells and budgets.

Learning outcomes

This lesson will help students to understand:

- How sediment cells (littoral cells) operate at the coastline and impact coastal systems.
- Where sources of sediment originate and contribute to the coastal system.
- What a sediment budget is and how it can be used to predict the changing shape of a coastline over time.

Suggested timing

2 hours

Possible teaching and learning activities

- Recap the coastal system diagram from previous lessons – ask different groups of students to recall inputs, outputs and flows within the systems.
- Watch the 10 minute coastal sediment cells video (YouTube) and ask students to link these ideas to the coastal system. Discuss how dynamic equilibrium at the coast is important for predicting future change and coastal management strategies.
- Ask students to research different sources of sediment in a coastal system and categorise into different types for example, clastic, biogenic etc.
- Use a blank outline map of the UK or part of the UK (e.g. the nearest coastline to where students live) and mark on sediment cells. Students can discuss what determines the location of the cells.
- Students can research one sediment cell in the UK and the characteristics of the coastal system within that cell. Produce an annotated map with located images to show the characteristics of the landscape.
- Research the sediment budget of a stretch of coastline. Identify areas at risk of erosion and areas where deposition is occurring. Students can predict alternative futures. For example impact of coastal management, sea-level rise.

- Draw simple flow diagrams to illustrate the concepts of positive and negative feedback on sediment budgets. This could be applied to different examples of sediment cells. For example, consider the story of Hallsands in South Devon where material removed from the cell had a catastrophic effect on the sediment budget.

Resources

- Explore the map by North East Coastal Observatory and information about North-eastern sediment cells.
- Read the article Coastal Systems: How a Sediment Cell and Sediment Budget Work (Tutor2U).
- Explore the diagram about sediment budgets for South Caroline, USA: Coastal Change Along the Shore of Northeastern South Carolina (USGS). They have many other examples.
- Read the information sediment budgets in the River Otter coastline areas Lower Otter, Devon (Geography SouthWest).
- Read the BBC article about Hallsands; The village that collapsed into the sea.

Geomorphological coastal processes

Specification content

3.1.3.2 Systems and processes

- Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.
- Distinctively coastal processes: marine: erosion – hydraulic action, wave quarrying, corrasion/abrasion, cavitation, solution, attrition; transportation: traction, suspension (longshore/littoral drift) and deposition; sub-aerial weathering, mass movement and runoff.

Learning outcomes

This lesson will help students to understand:

- How weathering, erosion, transportation and deposition processes form coastal landscapes.
- Different types of mass movement occur in coastal environments, changing the coastal landscape.
- How geomorphological processes work together to form coastal landscapes.
- Distinctive marine processes form coastal landscapes.
- Coastal landscapes are dynamic due to marine processes.

Suggested timing

2 hours

Possible teaching and learning activities

- Recap key terminology: weathering, erosion, transport and deposition.
- Use images of coastal features and discuss types of weathering operating at the coast – freeze-thaw, chemical, biological etc. Match these to the images.
- Draw simple diagrams to describe and explain types of weathering found at the coast.
- Give students definitions and key terms of marine processes and ask them to match key terms to definitions.
- Group discussion to establish the factors affecting the rate of coastal erosion. Students can draw diagrams to explain how differential erosion forms headlands and bays.
- Draw simple diagrams to explain types of transport – traction, saltation, suspension and solution.
- Show images of beaches affected by longshore drift. Students can draw a diagram on the image to explain why the beach changes shape.
- Use images of coastal zones and maps with prevailing winds – predict the direction of longshore drift.
- Class discussion about the conditions needed for deposition. What factors affect the rate of deposition. Link this to sediment budgets and sediment cells.

- Divide the class into groups and give each group a different type of mass movement – each group teaches the rest of the class about their mass movement type including an example of where it has happened.
- Use a media story of mass movement at the coast – investigate why it happened and what type of mass movement occurred.
- Students research a stretch of coastline, for example the Jurassic coast in Dorset and identify from maps and images, evidence for coastal processes.
- Fieldwork opportunity: visit a stretch of coastline and measure coastal processes such as rates of erosion, direction of longshore drift and changes in beach morphology due to deposition.

Resources

- Read the information on marine processes which covers basic coastal processes with useful video clips (A-level Geography).
- Read the article What is mass movement? (Internet Geography).
- Read the article on the Jurassic Coast (Royal Geographical Society).
- Read the article Landslides and coastal erosion at Aldbrough, East Riding of Yorkshire (British Geological Survey).
- Read the article Coasts fieldwork techniques (Royal Geographical Society).
- Watch the 2 minute video on Vanishing America: Nantucket's Coastline Erosion (YouTube). Provides some useful discussion points about rates of erosion, management and alternative futures.

Coastal landforms of erosion

Specification content

3.1.3.3 Coastal landscape development

- This content must include study of a variety of landscapes from beyond the United Kingdom (UK) but may also include UK examples.
- Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut
- platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.
- Recent and predicted climatic change and potential impact on coasts.
- The relationship between process, time, landforms and landscapes in coastal settings.

Learning outcomes

This lesson will help students to understand:

- How coastal morphology contributes to the formation of coastal landscapes
- How coastal erosion forms cliffs and wave-cut platforms. The factors that affect the cliff profile and its rate of retreat
- The different features of a cliff profile – caves, arches and stacks and the factors in their development over time.

Suggested timing

1 to 2 hours

Possible teaching and learning activities

- Question and answer task to differentiate between landscape and landform using images.
- Give students diagrams to show different characteristics of coastal morphology for example, dip, lithology, faulting, strata. Paired/group discussion to determine how these characteristics might affect coastal landscapes. Refer back to headlands and bays: discordant and concordant coastlines.
- Use geological maps of coastlines to determine how lithology affects the landscape and landforms in the UK and globally.
- Introduce images of coastal landscapes from around the world and ask students to identify landforms and features of the landscapes.
- For each erosional landform listed in the specification, ask students to draw an annotated diagram, include an image of a specific example and suggest how it might change in the future on a piece of A3 paper.
- Ask students to produce diagrams to sequence stack formation. This could be done as a 3D model using angel cake or modelling clay. Link to coastal marine processes operating in the cliff profile.
- Fieldwork opportunity: visit a coast with landforms of erosion, measure the height of cliffs or draw field sketches of erosional landforms.

Resources

- Explore UK geology maps BGS Geology Viewer (British Geological Survey).
- Watch the 6 minute video on coastal landscapes and process found in Australia (YouTube).
- Watch the series of animations showing the formation of cliff retreat and wave-cut platforms (eChalk).

Coastal landforms of deposition

Specification content

3.1.3.3 Coastal landscape development

- This content must include study of a variety of landscapes from beyond the United Kingdom (UK) but may also include UK examples.
- Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.
- Estuarine mudflat/saltmarsh environments and associated landscapes; factors and processes in their development.
- Recent and predicted climatic change and potential impact on coasts.
- The relationship between process, time, landforms and landscapes in coastal settings.

Learning outcomes

This lesson will help students to understand:

- The factors that affect the rate of deposition.
- How coastal deposition leads to the formation of different landforms.
- The characteristics and formation of landforms of deposition.
- The factors and processes in the development of mudflats and saltmarsh environments.
- How landforms of deposition change over time.

Suggested timing

3 hours

Possible teaching and learning activities

- Recap the factors that contribute to coastal deposition and affect the rate of deposition.
- Give unlabelled diagrams of beach profiles and ask students to investigate the different characteristics and annotate to describe and explain these characteristics. Students research images of different beach profiles to apply diagrams to real examples.
- Question and answer task discussing the reasons for difference in winter and summer profiles. Students could predict how these profiles might change with different scenarios for example more storms, sea-level rise etc.
- Watch a video showing the formation of sand dunes and write down key terminology.
- In groups construct a large diagram of sand dune successions. Each person in the group researches the characteristics of one area in the dune system for example Fore dunes, embryo dunes etc.
- Use a series of images of spits, bars and tombolos. Students use these images to describe the characteristics and research their development. Find two examples of each, one from the UK and one from beyond the UK.
- Draw diagrams of saltmarsh succession and annotate to show how the succession changes. Add located photos to show examples of each stage in the succession.

- Study an example of a spit (with a saltmarsh) in detail to consider how it has changed over time and the impacts of storm events and coastal management.
- Group research on examples of barrier islands and offshore bars. Each group to describe and explain the characteristics and development of the landform.
- Fieldwork opportunities: construct beach profiles, comparing two different beaches. Investigate succession in sand dunes or factors affecting sand dune formation.

Resources

- Read the webpage covering coastal landforms of deposition (A-level Geography).
- Watch the 4 minute video about the Sand Dune Formation and the Rock Cycle of the Oceano Dunes (YouTube).
- Watch the video of the Formation of Sand Dunes: Coastal Processes of the sand dunes in New Zealand 3 minutes (YouTube).
- Read the article about Hurst Spit - Historic Coastal Events (Wessex coast geology).
- View the PDF showing Chichester Harbour saltmarsh succession (Conservancy).
- Read the article on coasts fieldwork techniques - useful instruction on how to measure beach profiles (Royal Geographical Society).

Causes of sea-level change in coastal landscapes

Specification content

3.1.3.3 Coastal landscape development

- This content must include study of a variety of landscapes from beyond the United Kingdom (UK) but may also include UK examples.
- Eustatic, isostatic and tectonic sea level change: major changes in sea level in the last 10,000 years.
- Recent and predicted climatic change and potential impact on coasts.
- The relationship between process, time, landforms and landscapes in coastal settings.

Learning outcomes

This lesson will help students to understand:

- The reasons why sea-levels change – eustatic, isostatic and tectonic changes.
- How sea-levels have changed over the past 10,000 years.
- How climate change might affect sea-level in the future.

Suggested timing

1 hour

Possible teaching and learning activities

- Use graphs and maps showing sea-level changes over a variety of scales and timescales. Ask students annotate to describe changes.
- Class discussion on reasons why sea-levels change over time. Students could try to categorise these reasons.
- Introduce key terminology: eustatic, isostatic and tectonic. Ask students to classify reasons for sea-level change into these categories.
- Divide the class into three groups. Ask each group researches one category, producing a class resource such as an academic poster using maps, text and graphs to identify the key characteristics of sea-level change.
- Group discussion on how climate change can affect sea-levels. Draw simple diagrams to explain thermal expansion.
- Use maps and graphs to predict future sea-level changes as a result of climate change.
- There is an opportunity to use sea-level change data to practice data skills such as central tendency and standard deviation.

Resources

- Watch the 1 minute video Watching Rising Seas From Space showing 22 years of sea level change from space produced by NASA.
- Read the Natural History Museum article The making of an island showing sea-level change in the British Isles over past 100,000 years.
- Read the article Sea Level Rise with useful graphs and maps (Smithsonian Ocean).
- Read the useful resource from the BGS on sea-level change.

- Read the useful webpage Plate Tectonics and Sea Level Change (e-education) – There are lots of other web pages on the same website about sea-level change.

Impact of sea-level change on the coastal landscape

Specification content

3.1.3.3 Coastal landscape development

- This content must include study of a variety of landscapes from beyond the United Kingdom (UK) but may also include UK examples.
- Eustatic, isostatic and tectonic sea level change: major changes in sea level in the last 10,000 years.
- Coastlines of emergence and submergence. Origin and development of associated landforms: raised beaches, marine platforms; rias, fjords, Dalmatian coasts.
- Recent and predicted climatic change and potential impact on coasts.
- The relationship between process, time, landforms and landscapes in coastal settings.

Links with other units

3.1.1 Water and carbon cycles

3.1.1.4 Water, carbon, climate and life on Earth

The key role of the carbon and water stores and cycles in supporting life on Earth with particular reference to climate. The relationship between the water cycle and carbon cycle in the atmosphere. The role of feedbacks within and between cycles and their link to climate change and implications for life on Earth.

3.1.5 Hazards

3.1.5.2 Plate tectonics

Destructive, constructive and conservative plate margins. Characteristic processes: seismicity and vulcanicity. Associated landforms: young fold mountains, rift valleys, ocean ridges, deep sea trenches and island arcs, volcanoes.

Learning outcomes

This lesson will help students to understand:

- The characteristics of coastlines of emergence and the associated landforms.
- The characteristics of coastlines of submergence and the associated landforms.
- How climate change might affect coastlines in the future and alternative futures in landscape development.
- The impact of sea-level rise on coastal communities and the natural environment.

Suggested timing

2 hours

Possible teaching and learning activities

- Show students images of different submergent and emergent landforms. In groups discuss how they might have formed. Divide the images into submergent and emergent landforms.
- Link back to previous lesson through a class discussion about why you might get emergent and submergent landforms. Link to eustatic, isostatic and tectonic change.
- Research the British coastline and a coastline beyond the UK to identify examples of emergent and submergent sections of coast.
- Create a fact file using sketches/images and located examples for each landform listed in the specification. For each one, students should describe the landform and explain how it was formed. They could colour-code each landform to categorise it as emergent/submergent and then eustatic, isostatic and tectonic change.
- Discuss the impacts of observable sea-level rise and predicted sea-level rise on coastal areas; humans and the natural environment.
- Research project on one coastal community experiencing threats from sea-level rise. Examples could include the Maldives, Tuvalu, Kiribati and the Sundarbans National Park in Bangladesh. Research predicted impacts and mitigation strategies. Opportunity to discuss different viewpoints of stakeholders and community strategies versus global strategies.

Resources

- Read the article by Tutor2U Coastal Landscape Development - Features of Emergent and Submergent Coastlines.
- Read the Geography online resource with diagrams and text about emergent and submergent coastlines.
- Read the information about the threat of sea-level rise from C40 organisation.
- Read the NRDC information about impact of sea-level rise in the Sundarbans Bangladesh: A Country Underwater, a Culture on the Move.
- Read the NASA report on threat to Tuvalu - Sea Level Threat to Tuvalu.
- Read the article that details the importance of the Global South should be shaping policy as they are the most impacted; Views from the Global South: How to decolonise the climate crisis (Euronews).

Coastal management strategies

Specification content

3.1.3.4 Coastal management

Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management: shoreline management/integrated coastal zone management.

Learning outcomes

This lesson will help students to understand:

- Why different approaches to coastal management are needed.
- The costs and benefits of traditional approaches.
- How sustainable integrated approaches to coastal management can be used to protect coastal communities.
- The difference between shoreline management plans and integrated coastal zone management.
- The different values and attitudes towards coastal management.

Suggested timing

2 to 3 hours

Possible teaching and learning activities

- Refer back to previous lesson and discuss management strategies for sea-level rise and how these can be a variety of scales – local, regional, national and global. Discuss why do coastlines need more than a local response?
- Group discussion on management strategies used in coastal areas they have experienced. See how many students can name and or describe in one-minute.
- Give students a mix and match exercise for traditional approaches of hard engineering. They could sort type of structure, images, descriptions, costs. Discuss how they matched the costs to the structure. In groups decide on advantages and disadvantages of one structure and then feedback to the class.
- Students compile their own table of soft engineering strategies using similar headings to the exercise above.
- Fieldwork opportunity: visit a stretch of coast and conduct evaluations of management strategies, cost-benefit analysis and measurements of engineering strategies. Secondary data could be collected using satellite imagery.
- Introduce the concept of sustainable integrated approaches and how these differ from traditional approaches. Class discussion on why these might be more effective strategies.
- Individual student research on Shoreline Management Plans (SMP). Possible tasks include the background to SMPs, key aims and features of SMPs and SMPs on the British coastline.
- Produce a mini-guide to the features of the SMP most local to your school.

- Explain the benefits of Integrated Coastal Zone Management (ICZM). Research one example from beyond the UK, for example Trinidad and explain how it is better than traditional approaches.
- Hold a class debate about whether coastlines need protecting. Each group has a speaker and represents different approaches and/or different stakeholders. Each group can produce a visual aid to evidence their point of view.

Resources

- Read the Field Studies Council article Method for Coastal Management.
- Read the useful webpage about hard engineering with videos. Also has a page for soft engineering Coastal Protection and Management (A-level Geography).
- Read the UK government webpage on shoreline management plans.
- Read the article from Natural Resources Wales on shoreline management plans.
- Read the UK government PDF about ICZM in Trinidad: Integrated Coastal Zone Management Benefiting People?

Local scale case-study

Specification content

3.1.3.6 Case studies

Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes, their landscape outcomes as set out in the specification and engage with field data and challenges represented in their sustainable management.

Learning outcomes

This lesson will help students to understand:

- The factors that affect the case-study area for example geology, land-use, fetch and prevailing winds.
- The coastal processes impacting the landscape.
- The characteristics of the landforms found within the coastal landscape.
- Opportunities and challenges in managing the case-study area.
- Traditional approaches used in the area and the impact on natural processes.
- Sustainable management strategies used in the area.
- Future challenges and opportunities for the case-study area.

Suggested timing

3 hours

Possible teaching and learning activities

- It is advisable, where possible, to choose a local scale case-study. The coastline chosen does not have to be UK based but you may wish to choose a stretch of coastline that can be visited to conduct fieldwork.
- **Location and background to the case-study area:** use Ordinance Survey (OS) maps and/or atlas maps to describe the location. Use satellite images and OS maps to annotate the main features of the area.
- **Factors affecting the coastline:** use geology maps and research to annotate a sketch map of the coastline to show the factors affecting coastal processes and landforms. For example geology, label the fetch, prevailing winds, characteristics of the human population and land-use. Where applicable identify its sediment cell.
- **Coastal processes and coastal landforms:** use a range of resources such as OS maps, images and Geographic Information System (GIS) to build up a picture of the landforms present. Annotate images of the coastal landforms to show coastal processes present – weathering, mass movement, erosion, transport and deposition. Research information about the landforms to describe them and use old maps to show how the coastal landforms and landscape has changed over time.
- **Opportunities and challenges in managing the coastline:** class discussion using all the resources above to decide on how the coastal landscape provides opportunities for management and why it also has challenges. There is also an opportunity here to look at cost-benefit analysis of the coastline using secondary data or primary data through fieldwork.

- **Traditional approaches to management:** use research and images to produce a fact file on traditional approaches to management. Outline the strategy used and the impact on natural processes. Investigate how management has changed over time and its overall effectiveness.
- **Sustainable approaches to management:** investigate any shoreline management plans or ICZM's for your case-study area. Produce a guide to these outlining the main aims, characteristics and an evaluation of effectiveness.
- Through primary research where possible, or secondary data (e.g. newspaper archives) research different attitudes and values towards coastal management for your case-study area.
- **Future opportunities and challenges:** group presentations on how climate change might impact the case-study area using the themes above.
- This whole case-study could be done as a class presentation, dividing into groups and each group investigates a different section.
- **Fieldwork opportunities:** visiting the case-study area will allow students to gain first-hand knowledge and understanding of the area. They could conduct many of the techniques already suggested in this unit. This might also aid with NEA preparation and give students ideas of coastal themes for their NEAs.

Resources

The resources below use the example of Christchurch Bay, from Hengistbury Head to Hurst Spit found on the South Coast:

- Study resources - Poole and Christchurch Bays Flood and Coastal Erosion Risk Management - Read Extensive resources aimed at A-level students on Poole and Christchurch Bays including images, maps and links to the Shoreline Management Plan (Two bays).
- Watch the 6 minute overview video of processes and landforms from Bay House, Christchurch Bay (YouTube).
- Read the article Barton and Highcliffe - historical images and maps of coastal erosion in the Barton-on-Sea area (Wessex coast geology).
- Read the report Christchurch Bay and Harbour Flood and Costal Erosion Risk Management (FCERM) Strategy Engagement – Phase 2 (BCP Council) - detailed report on the viewpoints of local residents about coastal management strategies.
- Read the article Christchurch Bay and Harbour Flood and Coastal Erosion Risk Management (FCERM) Strategy (BCP Council).

Case-study of a contrasting coastline beyond the UK

Specification content

3.1.3.6 Case studies

Case study of a contrasting coastal landscape beyond the UK to illustrate and analyse how it presents risks and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation.

Links with other units

This depends on the case-study chosen. For the Sundarbans case-study suggested below, there are clear links to storm hazards.

3.1.5 Hazards

3.1.5.5 Storm hazards

The nature of tropical storms and their underlying causes. Forms of storm hazard: high winds, storm surges, coastal flooding, river flooding and landslides. Spatial distribution, magnitude, frequency, regularity, predictability of hazard events.
Impacts: primary/secondary, environmental, social, economic, political. Short and long-term responses: risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.

Learning outcomes

This lesson will help students to understand:

- The locational background to the case-study area.
- Coastal processes and the characteristics of the coastal landforms and landscape.
- The opportunities for human occupation and development.
- The challenges for human occupation and development.
- How humans can respond to the challenges, resilience, mitigation and adaptation.
- The future challenges and opportunities in the case-study area.

Suggested timing

2 hours

Possible teaching and learning activities

Choose a contrasting coastline beyond the UK. The chosen case-study should not be too large scale (e.g. choose a stretch of coastline or a small region of a coastal country) and should provide a contrast to the local scale coastline. You could conduct this as group research projects and students could study different areas and present their finding to the rest of the class. The resources below are for Odisha in North-Eastern India.

Location background: use atlas maps and GIS to locate the case-study area. Use a base-map to annotate factors impacting the coastline which can be added to throughout the lesson. Research the characteristics of the human population and land-use in the case-study area.
Coastal processes and landforms: use maps and images to identify the main characteristics of the coastal landscape. Link these to coastal processes. Consider the relative importance of these processes in the formation of the landscape.
Opportunities for human occupation and development: research the opportunities found in the areas. These could be classified into social, economic and environmental opportunities.
Challenges for human occupation and development: give students a range of images showing the challenges. In pairs investigate one of these challenges in more detail and present these to the class. Students can add these to their base maps.
Focus on one challenge in depth for example a tropical storm. Research how this impacted people and the natural environment.
Managing the coastline: research strategies used to manage the challenges along the coastline. Students can then categorise these into whether they show resilience, mitigation or adaptation. Use class discussion to evaluate the strategies. Consider ranking different strategies according to effectiveness. Discuss the challenges of doing such an exercise.

- Research traditional and sustainable approaches where possible. Contrast these strategies with those used in the local case-study. Consider the reasons for difference in the approaches used.
- Using different stakeholders, identify how different viewpoints might determine strategies used in the case-study area. Use this as a tool to discuss how there might be differences in human ability to use resilience, mitigation and adaptation as a response to the challenges in the area.

Future challenges: research how climate change might impact the coastline. For example consider how increasing frequency and/or magnitude of tropical storms could affect the human population.

Resources

These are some suggested resources for Odisha, India:

- Read the UN case-study article Coastal adaptation in Odisha.
- Watch the 9 minute video Managing Coasts by ICZM Project Odisha.
- Watch the 2 minute video "We live in fear" about the challenges of coastal erosion in Odisha (YouTube).
- Read the Guardian article No crops, no brides: how rising seas are killing India's coastal villages about rising sea-levels and the threat to Odisha's coastal communities.
- Read the article Enhancing communities resilience to disasters at Mahanadi Delta Region – about building community resilience in the Mahanadi delta area of Odisha (Caritas India).