SL IB Geography

Your notes

5.3 Managing Coastal Margins

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5.3.1 Coastal Erosion & Flooding Strategies


Your notes

Coastal Management

Coastline Management

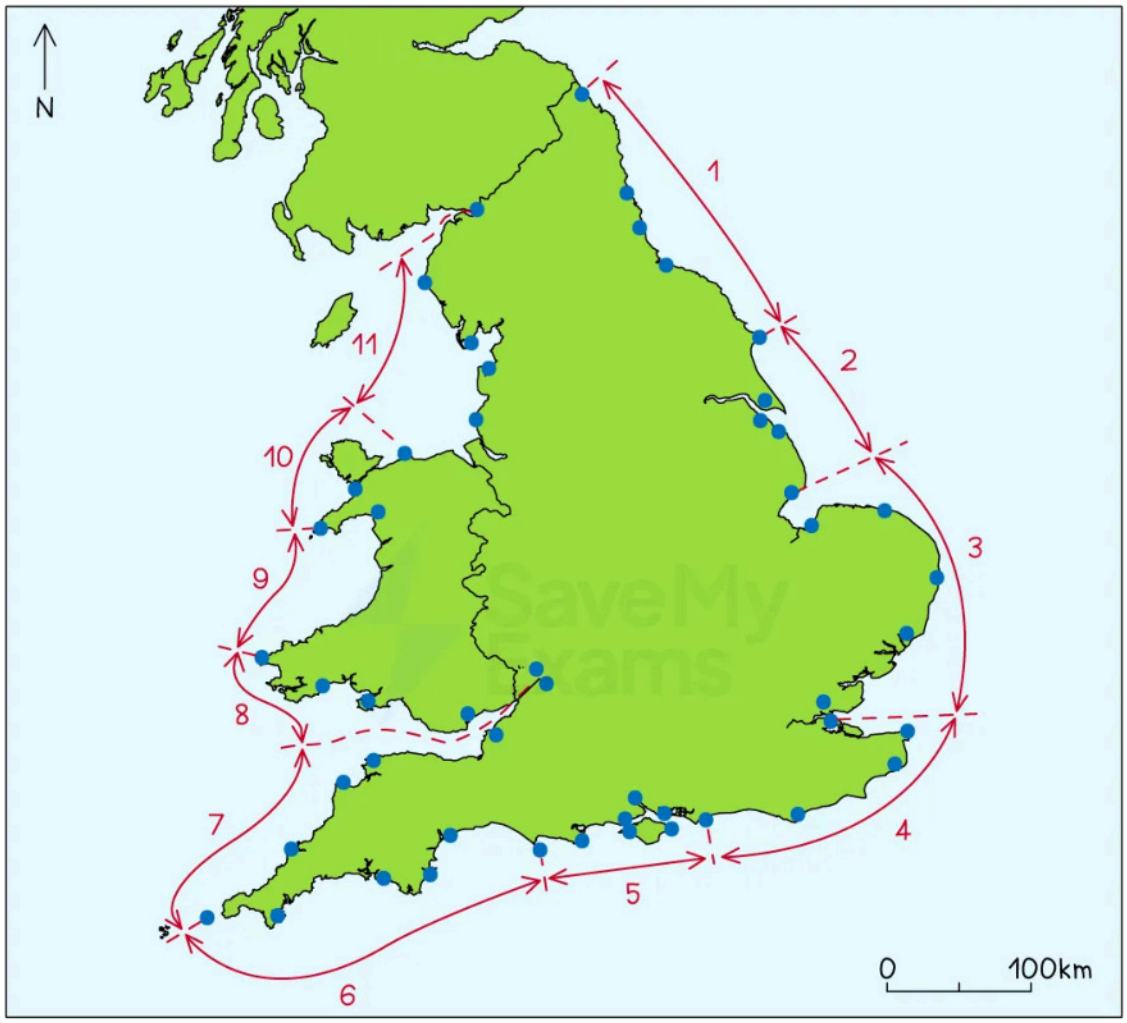
- **Sediment (littoral) cells** divide the coastline
- This cell system makes it easier for coastal planning and management
- Each cell has its own system of coastal planning and management
  - In England and Wales, there are 11 cells
- Management strategies protect our coastlines from emerging **threats**:
  - Flooding
  - Coastal erosion

Shoreline Management Plans

- A **Shoreline Management Plan (SMP)** operates in each cell
- SMPs consider the effects of different management strategies
- They aim to produce better management strategies in each cell
- There are 4 main types of shoreline management:
  - **Hold the line** – using **hard or soft engineering** to stop the shoreline retreating from erosion
  - **Managed retreat** – moving the coastline to a point further inland (realignment)
  - **Advance the line** – moving the coastline further into the sea
  - **No active intervention** – a typical "do-nothing", letting natural processes occur
- The type of management strategy depends on:
  - The threat of **coastal erosion** and **rising sea levels**
  - How much economic or agricultural **value** the land may have
  - Cultural or social **value** the land may have
  - Environmental and ecological **value**
  - **Cost** of management strategies

Coastal cells of England and Wales

Your notes



Coastal cells of England and Wales

Integrated Coastal Zone Management (ICZM)

- Within the coastal system, a change in one place may impact another
- The **ICZM** takes these issues into account with coastal management planning
- The **ICZM** is useful for understanding the coast as an entire **system** of marine processes, people, the environment, and onshore and offshore activities

- The ICZM aims to balance and manage all issues and viewpoints by:
  - Assessing what is occurring at the coast
  - Identifying all those affected and managing plans accordingly
  - Ensuring sustainability
  - Balancing the natural and the human
  - Discussing future changes and what could occur
  - Allowances for changing plans
- This means a **solution** will benefit all stakeholders


Your notes

Hard Engineering


Your notes

- **Hard engineering** is a method of coastal management
- These are **man-made** structures that help to reduce the risks of coastal erosion and flooding
- They significantly **change** natural coastal processes
- They are typically expensive and damage the environment
- Hard engineering solves issues at one point on the coast, but exacerbates issues in another area

Types of Hard Engineering

Management strategy	Definition	Advantages	Disadvantages
Groynes	Wooden, metal or rock barriers lining the beach, perpendicular to the ocean	Increase sediment build-up by trapping the sediment moved by longshore drift Builds up and widens beaches Reduces erosion in particular areas	Other areas experience increased erosion as groynes block sediment movement They are unnatural and unattractive and prevent leisure activities Expensive and require management
Revetments	Wooden, metal or rock slopes which absorb /deflect wave energy	Reduce erosion Cheaper than other hard-engineering methods	May need maintenance Can be unattractive and prevent beach access
Sea walls	Huge concrete structures that absorb/deflect wave energy	Their curved surface protects the land from flooding caused by storm waves Protect tourist areas e.g. beach huts Prevent erosion	Unattractive Very expensive – including maintenance Wave energy moves elsewhere, causing erosion
Gabions	Rocks enclosed by mesh at the bottom of cliffs	Absorb wave energy Cheaper	Metal wires may be subject to corrosion or breakages Unattractive and unnatural

Riprap (rock armour)	Large boulders at the shoreline	Absorbs wave energy Doesn't need lots of maintenance so cost-effective in the long run Looks more natural	Hazardous if rocks move Expensive to transport materials
Coastal barrages	Dam-like structures, partially submerged under the water	Keep the water level more consistent Used for hydroelectricity	Expensive Not environmentally friendly


Your notes

Soft Engineering


Your notes

- Soft engineering harnesses the power of **nature** to protect coastlines
- It is much less damaging to the environment than hard engineering
- It's **sustainable** – it's cheaper and more long-term

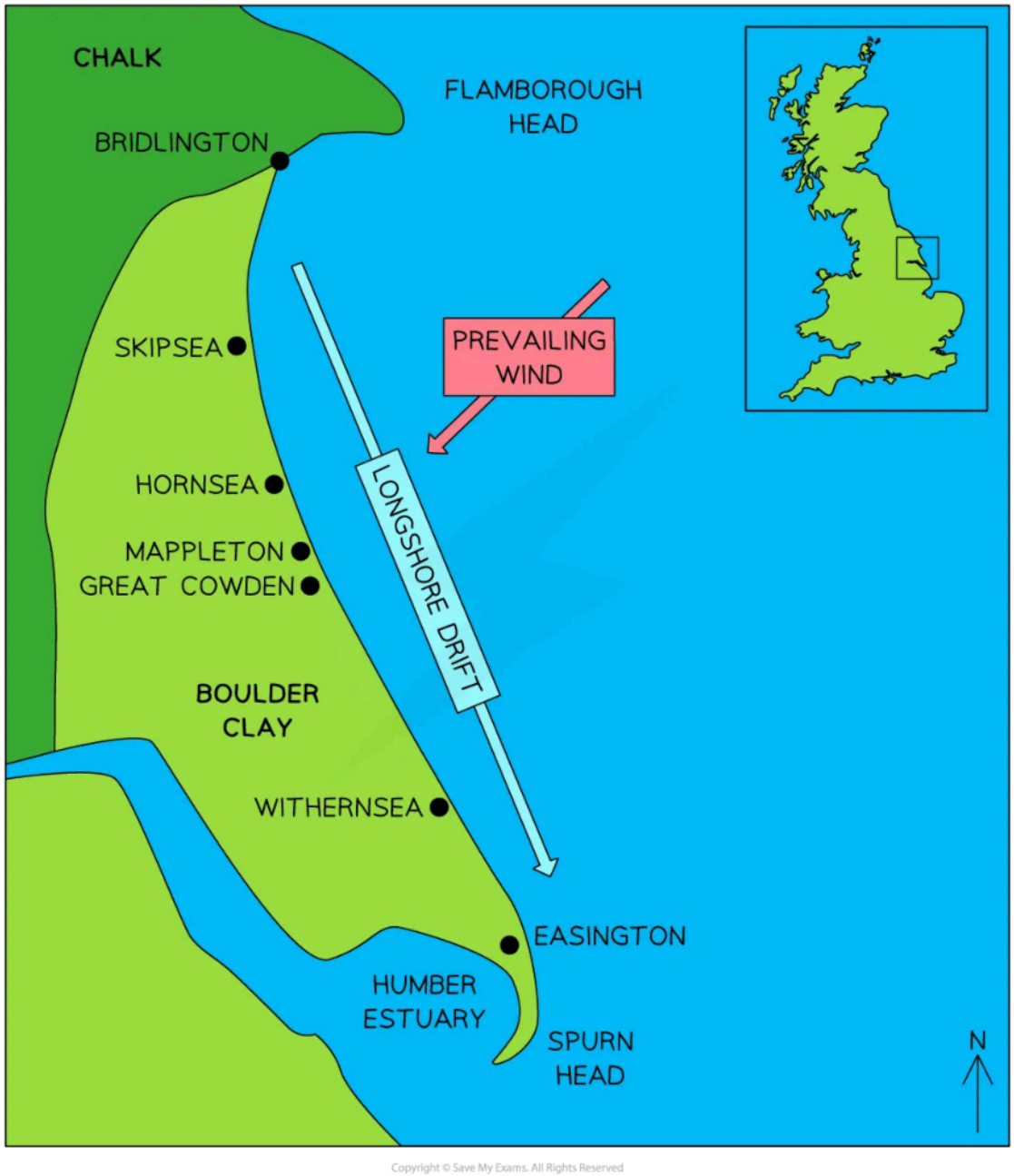
Types of Soft Engineering

Management strategy	Definition	Advantages	Disadvantages
Beach nourishment/replenishment	Expanding the beach by moving sediment into an area that has been subject to erosion	Improves the visual aspect and functionality of beaches Protects cliffs from erosion and inland areas from flooding risks	Requires repeated replenishment May have negative effects on the area where sediment was removed
Cliff regrading/stabilisation	Changing the shape of cliffs, e.g. changing the steepness of a slope	Reduces erosion and landslides Adding vegetation can give it a more natural look	Expensive Can cause habitat loss
Managed retreat (coastal realignment)	Leaving the shoreline to retreat naturally. Letting natural processes take over and breach current defences	Natural flooding defences can develop, e.g. salt marshes Sustainable and cheap	People may lose housing or land Can cause social issues Relocation of housing is costly
Ecosystem support e.g. dune regeneration	Adding vegetation and managing natural processes	Stabilises soil, which reduces erosion risks Looks natural and brings ecological benefits Cheap and sustainable	Can be easily affected by adverse weather or climate change Non-native species can impact the soil

Case Study: Holderness

Holderness Coast

Your notes



The Holderness Coast


Your notes

- Located in the East Riding of Yorkshire, running from Flamborough Head to Spurn Point, the Holderness Coast is home to features of erosion and deposition, such as caves, arches, stacks, stumps and spits
- One of the **fastest-eroding** coastlines in Europe
- **Soft clays** make up the coastline, causing a coastal retreat of around two metres per year
- Much land has already vanished over the past few hundred years
- The Holderness Coast is an important place to preserve, but it is under enormous pressure and in vital need of management

Shoreline Management of the Holderness Coast

- In 1991 in Mappleton, groynes were built to save the town and surrounding roads from coastal erosion:
  - **Cost-benefit analysis** showed it was cheaper to buy groynes than to rebuild a new road
  - This caused reduced sediment loads further down the coast. Increased erosion washed farmlands and livelihoods away
- This produced different **perspectives** on **holding the line** or **doing nothing**
- Politicians and councillors held "do-nothing" views, purely from a **financial** perspective because it would significantly reduce costs
- Locals favoured "holding the line", with **fears** of losing their homes and farmland
- Spurn Head is a spit on the Holderness coastline. Here, due to storm erosion, a "do-nothing" approach was decided upon
- Holderness Borough Council benefitted from reduced costs to protect Spurn Head
- "Do-nothing" forced the local community to relocate
- The Yorkshire Wildlife Trust had concerns about the importance of habitats and ecosystems and the heritage of the area
- This Shoreline Management Plan may have been effective for some but was a failure for others

ICZM at the Holderness Coast

- In 2000, the East Riding Yorkshire Council set up the **ICZM** for the East Riding Coastal Area
- This ICZM was created because of Holderness' main issues:
  - High erosion rates
  - Declining industries
  - Threats to communities
- The ICZM aims to manage social, environmental and economic problems across the entire Holderness coastline
- It also planned to re-evaluate the effectiveness and limitations of the Shoreline Management Plan

Effects and perspectives

- The 100-page ICZM document for the East Riding coastal area sets out its ICZM strategies
- The document outlines differing categories for its action plan
- Each category contains multiple policy action plans

An example of policy action plans in each category

Category	Policy action plan
Involving and implementing	Publishing the ICZM

Managing coastal change	Remove current defences that are unsafe
Transport	Park and ride and public transport improvement
Tourism	Encourage sustainability for local businesses through guidance strategies
Recreation	Education programmes, warning signs and water quality information
Land use planning	Design guides for coastal villages
Rural issues	Community partnership development
Environment/nature conservation	Education and campaign on marine litter
Archaeology and the historic environment	Create a project for coastal zone assessment to guide management decision-making
Fisheries	Improved policing of illegal activities e.g. dredging
Power generation	Discuss the potential for wind and wave energy
Business and industry	Training and upskilling


Your notes

Exam Tip

You don't need to memorise the entire ICZM for East Riding. Just make sure you are aware of the reasons why the ICZM was needed and a few examples of strategies and policies.

5.3.2 Land-Use Pressures on Coastlines


Your notes

Land Use Pressures & Conservation Measures

Land-use pressure in coastal areas

- Coastlines are subject to land-use pressure
- Various stakeholders use the coastline differently:
  - **Residents** – living comfortably in the area without disturbance
  - **Farmers or fishermen** – farming and fishing industries (commercial or subsistence)
  - **Business people** – developing tourist industry and other coastal businesses
  - **Industry officials and workers** – for factory work or quarrying
  - **Port authorities** – managing the port area
  - **Transport companies** – maintaining travel networks
  - **Wildlife** – living safely without human interference
  - **Environmentalists and conservationists** – maintaining and protecting habitats and vegetation (speaking on behalf of wildlife)
  - **Tourists** – using the beauty of the coastline area for recreation
  - **Developers** – building up the coastline for tourism and residential purposes
  - **Governments and councils** – protecting and maintaining the coastline
- The views of these stakeholders may **conflict**, especially when decisions by one stakeholder negatively affect another
- All stakeholders need the coastline in some way, so they **compete** with each other
- A **conflict matrix** can show where and how much conflict there is in relation to each other

An example of a conflict matrix at the coast

Your notes

	Bird Sanctuary	Fishermen	Oil & Gas Works	Residents	Tourists	Golfers	Farmers	Ferry Company	Industry
Bird Sanctuary									
Fishermen									
Oil & Gas Works	+++	+++							
Residents	+	++	++						
Tourists	++	++	++	++					
Golfers	+			+	+				
Farmers			++	++	+++	+			
Ferry Company				+					
Industry	+++	++		++	++		+		

Key	Level of conflict
+++	High
++	Medium
+	Low
Blank	No conflict

An example of a conflict matrix at the coast

Land-use pressure and conflicts

Stakeholder activity	Land-use pressure	Conflicts
Tourism	Coastal areas attract tourists with their natural **beauty** and **recreation** opportunities Tourism requires the development of hotels and entertainment facilities Tourism puts pressure on the coastline, e.g. pollution, littering, overcrowding, resource pressure, destruction of habitats, congestion Tourists argue that coastal **maintenance** is important to keep tourist access available	Locals and environmentalists conflict with tourists over sustainability and conservation
Industry and development	Coastal environments have industrial uses They are home to **industrial activity** like energy production, e.g. oil, and gas refineries, quarrying Coastlines house shipping areas and ports Industrial activities are unsightly, cause pollution, eutrophication, and degradation of natural areas and habitats **Urbanisation** development increases pressure on the coastline e.g. new housing, car parks, transportation routes and other necessary infrastructure	Can cause conflicts with locals and environmentalists Tourists may conflict with industrial developers
Residents and housing	Many **residents** live in coastal areas, from city commuters to retirees Residents and locals of coastal areas are against large tourist and industrial activity Some locals worry about coastal erosion and flooding, and focus their attention on pushing for coastal management	Locals may conflict with tourists, industry developers and advocates for "do-nothing" management strategies
Agriculture and fishing	Fishing in coastal environments is some people's **livelihood**	Locals and environmentalists conflict with farmers and fishermen


Your notes

	Fishing industries require processing areas, transport routes and other resources This can cause **overfishing** and **pollution** Coastal areas are also home to agricultural activity This can result in fertiliser, pesticide and animal waste pollution, land reclamation and **coastal squeeze**, overuse of the land and habitat destruction	
Coastal management	Coastal management is a vital tool for protecting coastlines from erosion and flooding There are both advantages and disadvantages to hard and soft engineering strategies There are both winners and losers. Some stakeholders will benefit and some will be negatively affected by management strategies	Conflicts can arise between winners and losers
Conservation measures	Environmentalists and conservationists work to protect coastal habitats and ecosystems Protection and preservation of the environment is a top priority	Conflicts can arise between environmentalists and those wishing to exploit or freely use the coastline e.g. industries, tourists and local residents


Your notes

Exam Tip

Make sure you learn about who conflicts with whom. Are locals angry at industries? Are environmentalists angry at tourists? You might be asked to discuss the conflicting opinions of coastal areas.

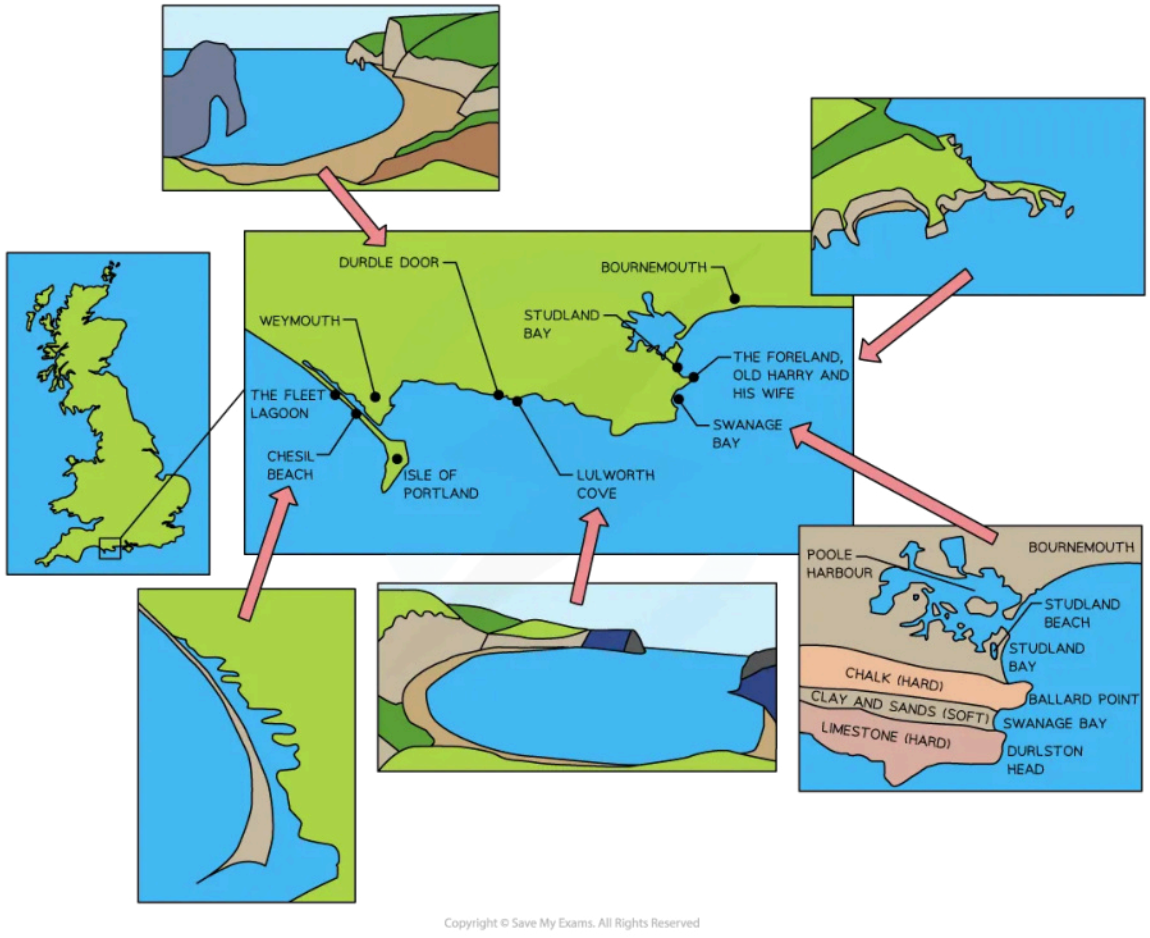
Case Study: Dorset Coast

Your notes

Dorset, UK

- Dorset is located in south-west England
- It is part of the Jurassic Coast
- It became a World Heritage Site in 2001

Map of the Jurassic Coast



Map of the Jurassic Coast

Uses of the Dorset Coast

- Stakeholders use the **Dorset Coast** in different ways
- Each stakeholder has a different role on the coastline
- Conflicts have arisen between stakeholders
- Each stakeholder has a **role** in minimising conflicts between other stakeholders

- Outcomes of conflict strategies may be effective or ineffective
- **Tourism**
  - Water sports are common in this area e.g. swimming, yachting and windsurfing.
  - There are footpaths along the coast for tourists with points of geographical interest e.g. famous coastal landforms like Durdle Door, Old Harry etc.
- **Military**
  - The military/army uses part of the coastline for training e.g. Lulworth Army Range
- **Environmentalists/wildlife**
  - There is rich biodiversity of the coastal landscape
  - It is famous for bird-watching sites and Nature Reserves
- **Heritage**
  - There are historical areas e.g. Corfe Castle, Tom Hardy's old cottage
  - These attract tourists but are vital for maintaining the historical importance of the area
- **Locals and farmers**
  - Many people inhabit the coast
  - Roughly 750,000 people live in the Dorset area
- **Industry**
  - Quarrying takes place along the coast


Your notes

Conflicts and outcomes

Role of stakeholder in land-use pressure	Outcomes
Environmentalists and **locals** conflict with **tourists** Tourism brings issues like pollution, congestion, footpath erosion, littering and sand dune damage Second homeowners cause problems with housing affordability and cause service closures in off-peak seasons	Better management of land e.g. National Trust/Dorset Wildlife Trust maintain the footpaths Improved transport e.g. trains, cycle paths and bus routes to reduce congestion Better education for tourists and eco-responsibility (leaflets, posters) Stricter punishment for littering e.g. fines Litter picking projects The government supports home ownership schemes to reduce the number of **second homes** World Heritage means that there are stricter development rules, reducing dangerous development plans Revegetation at Sites of Special Scientific Interest to protect sand dunes Nature Reserve label to increase protection of and funding for wildlife and vegetation

Tourists, **locals and farmers** may conflict with the military Military noise can be a problem for livestock Certain areas forbid tourists	Zoning areas to separate activities and allow tourists to access the area Improved signage to make tourists and locals more aware of when military drills or testing occur
Tourists, farmers, locals and environmentalists conflict with **industry** (quarrying) Vehicles used for industry are loud and heavy, can damage roads and cause congestion Dust from quarrying can choke vegetation **Quarry blasting** is loud (for locals and tourists) Quarrying can also increase the risk of coastal erosion, which is worrying for many stakeholders	Washing lorries before they leave the quarry site to remove dust Transport materials via train, to avoid the road Plan vegetation to cover the eye-sore of quarry sites


Your notes

Exam Tip

Make sure you understand the different conflicts in coastal areas. Be prepared to discuss how those conflicts can be reduced using a case study. You may need to think about how effective the outcomes are.

5.3.3 Management of Mangrove Swamps

Your notes

Mangrove Swamps Characteristics

Characteristics of mangrove swamps

- Mangrove swamps are **wetlands** located in coastal areas
- They thrive in **tropical** or **subtropical** areas with a good sediment supply
- Mangrove swamps are located in the intertidal zone
- This means that mangrove swamps deal with regular environmental disruption, as sea levels change
- Vegetation found in mangrove swamps is halophytic and thrives in brackish environments
- Mangroves produce dense thickets of mangrove trees with tangled roots above the ground
- Mangrove trees have **breathing roots** to absorb oxygen
- Some trees have **buttress roots**, which help to support the tree in the softer sediment
- These roots trap sediment, building up the land and reducing erosion
- Due to the **high saline** and **low oxygen** environment, germination is difficult:
  - To deal with this, seeds germinate while they are still attached to the mangrove plant.
  - They float around in the water before eventually taking root
- Mangrove forests are home to all sorts of species. They are incredibly productive environments

Diagram of mangrove swamps

Your notes

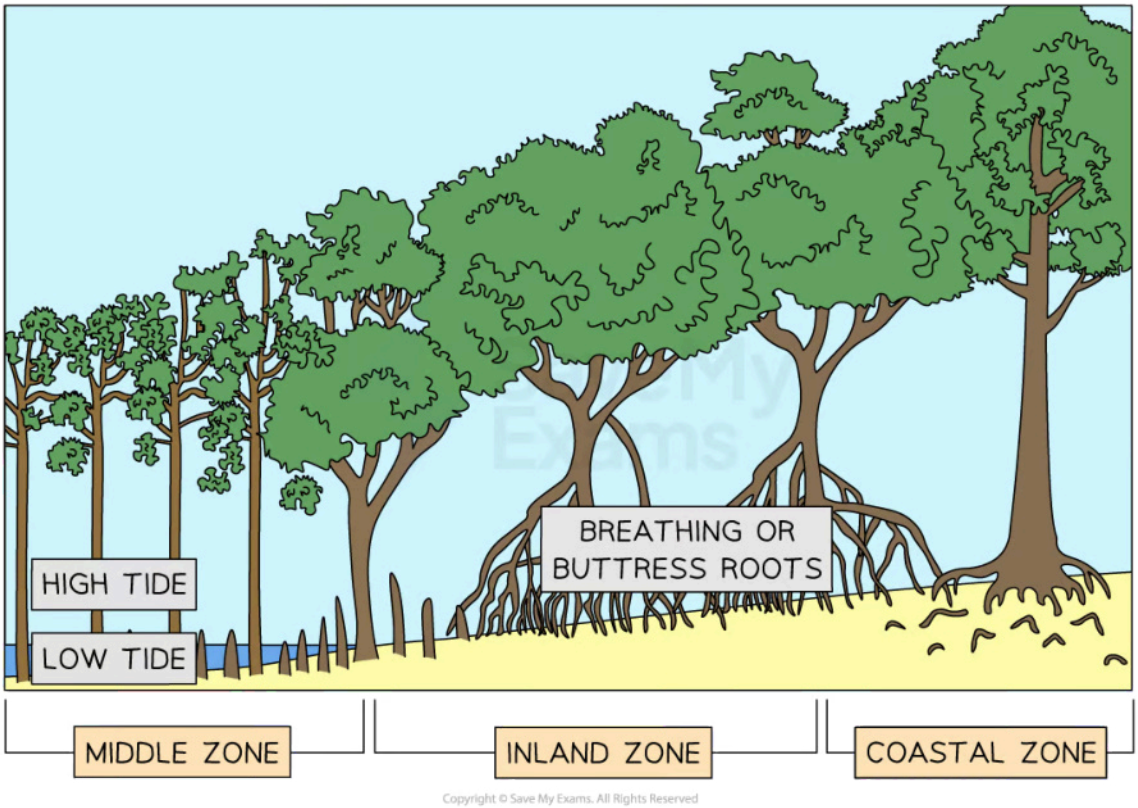


Diagram of mangrove swamps

Mangrove Swamps Uses & Value


Your notes

Uses and value of mangrove swamps

- Mangrove swamps are extremely valuable
- Stakeholders value and use mangrove swamps differently e.g. environmentalists, locals, fishermen etc.
- Mangrove swamps are also under threat
- Over half of the mangrove forests of the world no longer exist
- Stakeholders from all perspectives must work together to reduce threats to mangrove environments
- **Coastline protection**
  - Mangrove roots stabilise the sediment, slowing down wave erosion
  - Mangrove trees protect coastal areas from storm waves and tsunamis by absorbing wave energy
  - Swamps absorb water from storm surges or rainfall, reducing coastline flooding
- **Habitats and ecosystems**
  - Mangrove swamps are rich habitats for mammals, insects and marine life
  - They are vital nesting areas, particularly for migrating birds
- **Pollution**
  - Mangrove forests can trap pollutants in run-off stormwater
  - This protects coral reefs and other habitats from dangerous water pollution
  - This also protects waterways used by locals living nearby
- **Resources**
  - Mangrove swamps are rich fisheries, used in the seafood industry
  - They are vital for people's livelihoods and access to food
  - They are ideal for medicine, charcoal and wood resources
- **Carbon sink**
  - As the sediment and soil in mangrove swamps are so nutrient-rich, they can store carbon
  - Mangrove forests can store billions of tonnes of carbon. If this was released, it could be catastrophic for the environment

Exam Tip

Think about which stakeholders would benefit from mangrove swamps. Why do environmentalists benefit? Why do local populations benefit?

Threats to mangrove swamps

- **Clearing**
  - Swamps are cleared for agriculture, aquaculture, farming, tourism, settlements and harbours
- **Overuse**
  - Overharvesting is unsustainable and can threaten the future of mangrove swamps
  - Overfishing in the ocean can impact marine life and marine food chains in mangrove environments
- **Water changes**
  - Irrigation and damming can affect the salinity of mangrove swamps
  - With an increase in salinity, mangrove vegetation can't survive

- Increased sediment from erosion caused by deforestation can choke mangrove swamps
- Climate change is causing sea levels to rise. Mangrove swamps require stable sea levels to thrive

- **Pollution**
  - Rivers can bring fertilisers or pesticides into mangrove environments, killing species
  - Oil pollution also chokes mangrove roots, meaning the trees cannot get enough oxygen
- **Coral reef destruction**
  - Coral reefs absorb powerful wave energy
  - As coral reefs degrade, powerful waves can reach the coastline. This affects the sediment in mangrove environments
  - Nutrients and seedlings can wash away


Your notes

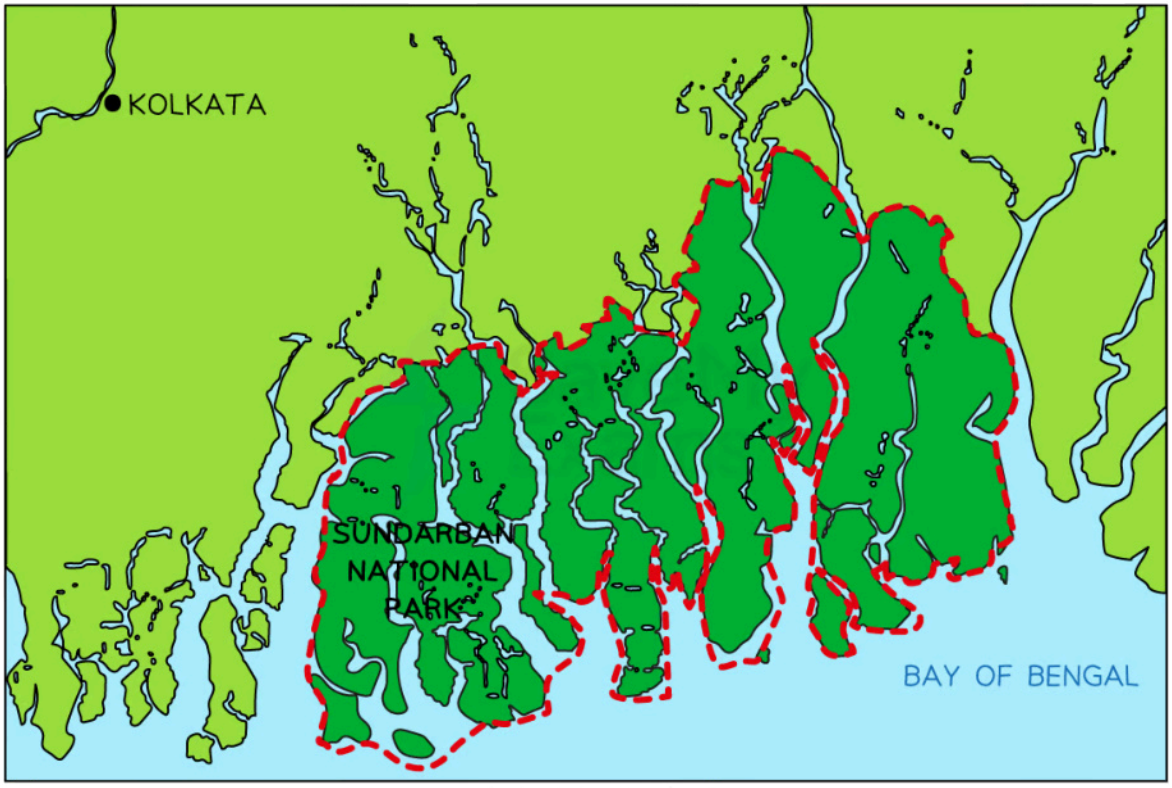
Exam Tip

Make sure you know the value and effects of both mangrove swamps and coral reefs. You might be asked to compare the two or discuss the threats of both.

Case Study: Sundarbans

Your notes

Bangladesh, Sundarbans



Map showing the location of the Sundarbans

- This mangrove forest lies in the delta of the Bay of Bengal
- It is roughly 10,000 square kilometres
- It became a **UNESCO World Heritage Site** in 1997
- It is home to all kinds of species, such as the Bengal tiger, deer, crocodiles and snakes
- The mangroves are vital for storm protection
- They are useful for resources e.g. fish, timber and fuel wood
- This mangrove swamp is a great example of mangrove management

Threats

- Increased settlement and agricultural growth
- Deforestation for food, shelter and fuel
- Barrages or dams for irrigation
- Ownership difficulties with poor management plans
- Construction of coastal embankments, affecting sediment
- A general misunderstanding of mangrove importance

Management strategies


Your notes

- **World Heritage Status** – international law protects this mangrove environment
- **Wildlife refuge** areas – this stops people from entering the area, as well as from using or damaging the land for other purposes
- **Eco-engineering** e.g. mangrove afforestation – a project beginning in 2011 saw the planting of 16 million mangrove plants. This increased protection from flooding for local settlements and brought rich biodiversity
- **Co-management** – many different stakeholders can work together to support mangrove swamps. This will help to balance conservation strategies and sustainable use of mangrove environments
- **Education** – educating all stakeholders on the rules and management of mangroves is vital. Education has contributed to a new version of the Integrated Resource Management Plan (IRMP), which focuses on sustainable management of the Sundarbans
- **Spatial monitoring** – spatial tools provide data on any illegal activities, patrolling and biodiversity change
- **Ecological monitoring** – helping to predict threats that require responses
- Each year, smaller **fishing camps** ensure locals still have access to fish supplies

5.3.4 Management of Coral Reefs

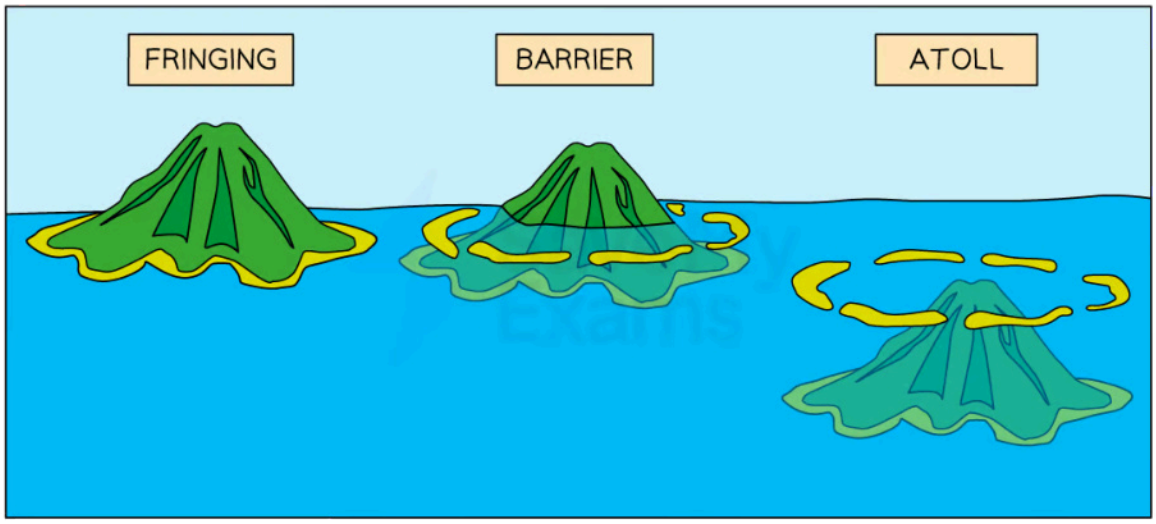
Your notes

Coral reef Characteristics

Characteristics of coral reefs

- Coral reefs are **productive** environments
- **Warm** coral reefs are located in tropical and subtropical waters (above 18°C)
- **Cold** tropical reefs are located in deep, dark waters (4–12°C)
- Coral reefs are also **fragile** environments
- Any slight change in a coral reef environment can have devastating effects
- Coral reefs form by small coral larvae (**polyps**) attaching themselves to rocks
  - Polyps secrete **calcium carbonate**, creating a hard **skeleton**. Other polyps can then connect to this skeleton
  - Polyps can divide (**clone**) themselves. These clones connect, forming a large organism
  - These organisms connect further over time, forming large coral reefs
- There are three differing structures of a coral reef:
  - **Fringing reefs**
    - The most common form of coral reef
    - Exist close to coastlines, like a border
  - **Barrier reefs**
    - Barrier reefs also exist on coastlines, but a **deep lagoon** separates the shore and the reef
    - Can form as fringing reefs grow and connect with each other
    - Very **rare** forms of coral reef
  - **Atoll reefs**
    - As a volcanic island sinks beneath sea level and a fringing reef encircles it, atoll reefs form
    - They are **circular** shaped, with a lagoon in the middle
    - Found in the middle of the ocean

Formation of three coral reef structures



Formation of three coral reef structures

Your notes

Coral Reefs Uses & Value


Your notes

Uses and value of coral reefs

- Coral reefs are **valuable** ecosystems
- **Stakeholders** value and use coral reefs differently
- Coral reefs are also dangerously under threat
- All stakeholders must work together to reduce threats to coral reef environments
- **Coastal protection**
  - Coral reefs reduce the impact of strong storm waves, helping to reduce the erosion of the coastline
  - They protect coastal landscapes (e.g. mangrove swamps) and local communities
  - Coral reefs are valuable to local residents and environmentalists
- **Resource use**
  - Fish are abundant in coral reef environments. This provides food and livelihoods for local residents
  - Both **commercial and subsistence** fishing occur in coral reef environments
  - Coral reefs help to develop medicine. The biodiversity of reef systems provides treatments for diseases including cancer, asthma and other bacterial or viral diseases
  - Coral reefs are valuable to fishing industries and science development
- **Tourism and the economy**
  - Coastal areas with coral reefs attract millions of **tourists** each year
  - Divers and beach lovers alike bring vital tourism to coastal areas
  - Coral reefs boost the economy by providing **jobs** and bringing tourism to the area
  - From accommodation to boat crews, income from tourism is important for coastal communities
  - Coral reefs are valuable to tourists and the tourist economy
- **Species habitat**
  - Coral reefs are home to all types of species; they are incredibly **biodiverse**
  - From fish to mammals, coral reefs provide food, shelter and nursery for an estimated 25% of all marine life
  - Coral reefs are valuable to marine life and environmentalists

Threats

- **Development**
  - Coastline development for commercial and non-commercial practices puts pressure on coral reefs
  - Activities like quarrying, **dredging**, boating practices and recreation can damage coral reefs
- **Overfishing and harvesting**
  - Overfishing of coral reef environments can be disastrous for the food web
  - Coral reefs need fish to remove dangerous algae
  - **Blast fishing** can damage coral reefs' structure
  - Harvesting coral reefs for the jewellery/souvenir industry can damage biodiversity and cause habitat destruction
- **Pollution**
  - Increased **sediment** (from development, agriculture, deforestation etc.) can choke coral reefs

- Coral reefs require very little nutrients to function. More nutrients enter the coral reef environment from fertilisers, sewage and animal waste
- Algae growth increases with higher nutrient densities and uses vital oxygen and blocks sunlight
- More harmful bacteria also grow with higher nutrient densities
- Diseases enter coral reef environments from sewage, storm runoff and industrial and agricultural runoff
- **Rubbish** and **microplastics** also damage coral reef ecosystems

- **Acidification and bleaching**
  - Algae gives coral reefs their colour
  - As sea waters warm, coral reefs get rid of this algae, causing coral reefs to lose colour.
    - This is **coral bleaching**
    - This exposes the calcium carbonate and leaves corals under stress
  - As carbon dioxide in the atmosphere rises, so too do carbon dioxide levels in the ocean
    - Carbonic acid increases, resulting in **ocean acidification**


Your notes

Exam Tip

Think about which stakeholders would benefit from coral reefs. Why do environmentalists benefit? Why do local populations benefit?

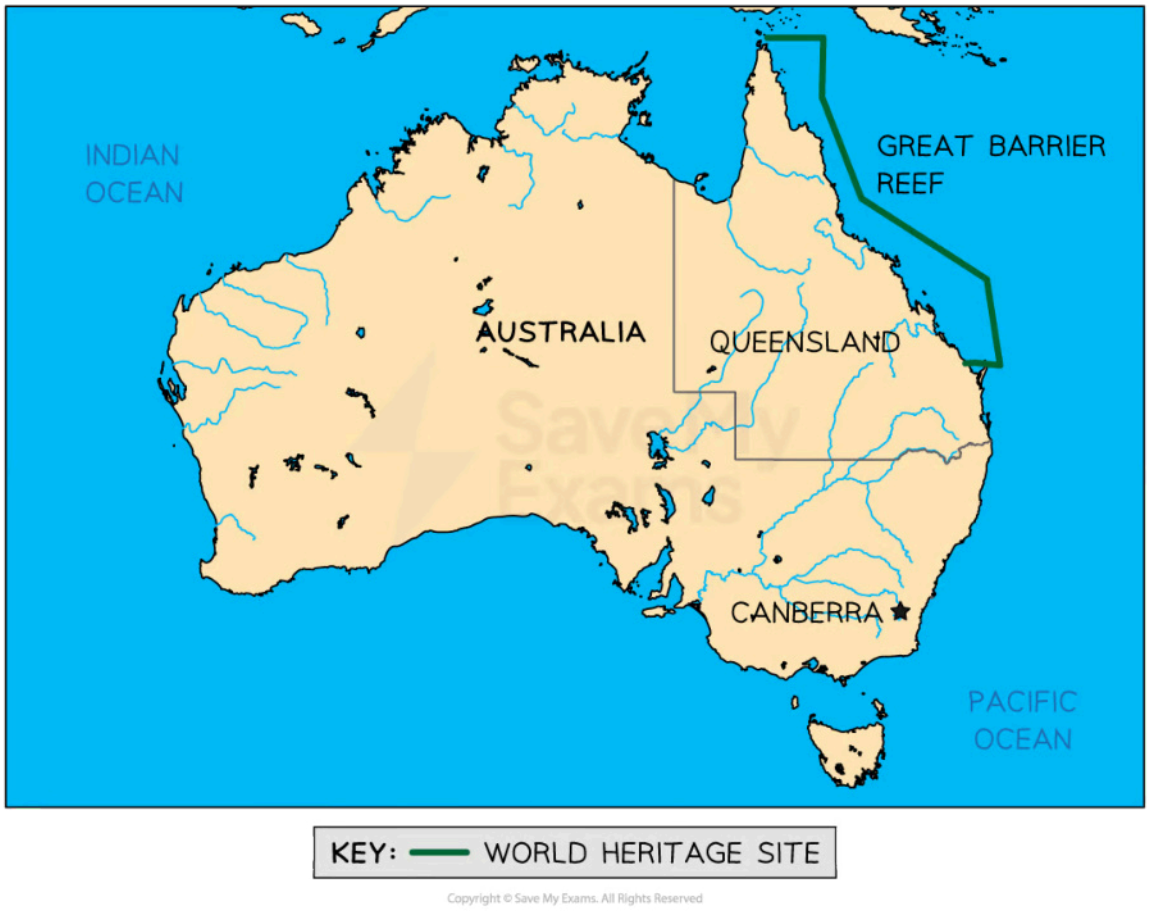
Case Study: The Great Barrier Reef

Your notes

The Great Barrier Reef, Australia

- The Great Barrier Reef is the largest coral reef environment in the world
- Located in the northeast of Australia, along the coastline of Queensland
- It is over 1250 miles long

Location of the Great Barrier Reef



Location of the Great Barrier Reef

Threats

- **Climate change**
  - Sea waters around the Great Barrier Reef are rising in temperature, resulting in coral bleaching
  - Fears of flooding and storm intensity are exacerbated by climate change
- **Runoff**
  - Increased runoff from agriculture is a large issue
  - This increases nutrients, sediment and pesticides in the water

- **Development**
  - Past, present and future development poses a threat to the reef
  - These are agriculture, mining, urbanisation, industrial development, port development, aquaculture and tourism development
- **Fishing and poaching**
  - Overfishing
  - Illegal fishing
  - **Incidental catch**
- **Scale**
  - The Great Barrier Reef is vast. It is difficult to find enough funding, resources and people to protect the area
- **Invasive species**
  - Crown-of-thorns starfish
  - Lionfish


Your notes

Management

- **World Heritage Site and a Natural Wonder of the World** – this provides lawful protection and global recognition
- **Legislations**
  - Created for The Great Barrier Reef area, Queensland, The Commonwealth, and the International level
- **Reef 2050 plan**
  - Long-term plan for reef sustainability
  - Bringing together governments, local communities and industries
  - Assesses values and threats to the reef, guiding professionals to where management is most necessary
- **Education**
  - Education and training is important for people like tour guides
  - Presentations on reef protection regularly show at the Marine Park Authority Office
  - Regular research is carried out to assess management strategies and their effectiveness
  - Universities in Queensland offer courses for coral research
- **Tools**
  - **Zoning plans**
    - Guiding where activities and industry can and cannot take place
    - Includes 'No Take Zones', 'Scientific Research Zones', 'Green Zones' for recreation, and 'General Use Zones'
  - **Permits** – most activities require a permit, e.g. tourism, infrastructure construction, boating
  - **Policies** – environmental, scientific and tourist government policies are set in place
- **Balancing stakeholders**
  - **Tourism management**
    - Balancing the importance of tourism while protecting the reef
    - Guidance on managing reef tourism
    - Future plans for tourism to be ecological as well as respectful to the heritage of the area
  - **Heritage management**

- Respecting **Aboriginal** ownership of land and knowledge of the area
- Working with **Aboriginals** and **Torres Strait Islanders** to protect the reef together
- Training, programs, mapping and action plans
- **Science management**
  - Using scientific evidence to guide management practices
- **Monitoring**
  - **Fluker posts** involve tourists in monitoring strategies
  - Tourists use these posts to take pictures of the reef
  - Photos are transferred to a site for professionals to examine
  - **Cost-benefit** – this saves money and time for workers
- **Species protection and control**
  - Some species have different levels of protection (international, national, state or local)
    - This means they have **lawful** protection
  - Species are also separated into **threatened, at-risk** or **iconic**
  - Some species must be **controlled** due to their negative impact, such as crown-of-thorns starfish outbreaks
    - Professional divers inject starfish to kill them (without harming the environment)
- **Reef restoration**
  - **Planting** vegetation in canals to reduce sediment
  - **Coral IVF** – growing baby corals outside of the reef and replacing them back into degrading areas
  - **Coral fragments** – taking fragments and planting them elsewhere (underwater or onshore in tanks)
  - **Cryopreservation** – freezing tissue in nitrogen for future preservation, reducing the risks of species extinction
  - **Photogrammetry** – monitoring the growth of the coral reef
- **Traditional management**
  - **Indigenous People** are using traditional and modern **tracking** methods to track animals like turtles
  - There is a priority for **subsistence** fishing, limiting overfishing
  - Some areas of the reef are **taboo**, increasing protection
  - Some areas of the reef **belong** to Indigenous Groups


Your notes