COASTAL EROSION

For a named coastal area you have studied, describe attempts to manage erosion.
For a named area of coastline you have studied, state the hazard experienced there and explain what has been done to reduce the risk of it.
Content guide Hard and soft engineering methods of managing erosion. <u>Hard engineering methods</u> - Sea walls - Groynes - Revetments - Gabions - Rip rap - Offshore breakwaters <u>Soft engineering methods</u> - Beach nourishment - Planting vegetation on cliffs - Draining water from cliffs - Managed retreat - Provision of cyclone shelters - Education re emergency evacuation procedures - Planting of mangroves <u>Note:</u> Example is not a country unless small such as Hawaii or Mauritius.
Place specific reference: Places along coastline, Specific details/costs of methods.

<u>KERALA</u>

<u>Introduction</u>

- State on southwest edge of India
- 590 km of coast.
- According to a study in November 2018, 60% of the coastline is under erosion.
- 9 coastal districts, of which the coastline of Thiruvananthapuram is most prone to erosion.

Hard engineering methods

- The efforts to control coastal erosion through hard engineering methods / structures was initiated along Kerala coast more than 100 years ago.
- As a result, 53% of the coast is classified as‘artificial coast’.
- There are 106 groynes and 25 breakwaters along the coast.
- Seawalls, rip raps, revetments, groynes have been constructed on 310 km of coastline.
- In 2022, Pinarayi Vijayan (chief minister) inaugurated a new coastal protection project that included a seawall made of concrete structures called tetrapods and a network of groynes. This was to provide relief to Chellanam district, that was heavily affected by cyclone Tauktae in in 2021
- First phase of the project includes a new sea wall along a 7-kilometre stretch from Chellanam harbour to Puthenthode Beach.
- Geo tube model: Kerala is installing giant tubes filled with synthetic fabric along its coast.

Soft engineering methods

- In Thiruvananthapuram, hard engineering methods aggravated coastal erosion and caused it to spread to nearby beaches.
- Many of these structures did not last their span of 25-30 years.
- Government prepared a‘Shore Management Plan’to protect Kerala’s coast through eco-friendly solutions: beach nourishment, mudflats, coastal wetlands, mangroves, sandy beaches.
- May 23, 2016, Wildlife Trust of India (WTI), announced the launch of a mangrove restoration project in the Kannur district of Kerala, which could act as a buffer to erosion.

For a named coastal area you have studied, explain how coastal erosion has affected the people who live there.
Content guide - Loss of farmland - Damage to properties - Loss of gardens - Danger from falling rocks/collapsing cliffs - Access restricted - Loss of tourism - Damage to roads/railway lines

- Cost of management including /increased rates/taxes
- Unable to insure properties

KERALA

Loss of land: 650 acres of land has been eroded away from the shore in Thiruvananthapuram over a 14-year period.

Damage to housing

- Coastal erosion heavily impacts fishermen & their families: downtrodden.
- 110 families in Valiyathura (near Kovalam) have lost their homes.
- Many families are forced to live inside school buildings due to loss of their homes.
- These temporary shelters have very few toilets and no beds to sleep in.
- The government has relocated almost 30,000 families from coastal areas.

Loss of tourism & restricted access:

- Erosion has especially affected tourism in areas like Kannur, and beach access is restricted

Cost of management: Rs 1,500 crore was allocated to protect the coastline.

Unable to insure property: Because coastal erosion is a natural process that is impossible to prevent, it isn't easy to find insurance that will cover it.

NATURAL HAZARDS

For a named area of coast you have studied, describe the natural hazards faced by people.
Content guide - Erosion - Coastal flooding - Tropical storms, etc. - Tsunamis - Landslide - High waves/freak waves
Place specific reference: Named places, Named storms etc.

KERALA

High waves/freak waves: coastline of Kerala exposed to high waves / rogue waves called ‘kallakadal’, which results in rampant coastal erosion and coastal flooding.

Coastal erosion

Tsunami

- 26 Dec 2004, Tsunami affected sewage systems and contaminated groundwater supplies.
- 187 villages in the Quilon-Alleppey districts were affected.
- Over 1924 ha of mangrove were affected.
- Almost 1,54,000 houses damaged.
- 177 human lives lost.
- Damage was estimated to be around Rs. 2371.02 crore.

Tropical storm

For a named coastal area you have studied, describe the impacts of a tropical storm.
Content guide - **Death/injury** - **Damage to homes** - **Loss of property/possessions** - **Flooding** - **Damage to vegetation** - **Impact on agriculture** - Roads/railways blocked - **Electricity supply disrupted** - Economic impacts - Impact on tourism - Water-borne diseases - Secondary/long term impacts NB: Development is of the descriptions e.g. houses destroyed so people are homeless. Not houses are destroyed because they were built from weak materials.
Place specific reference: Specific details of the areas affected, Statistical information e.g. deaths/damage, Name of storm/date, etc.

KERALA

Introduction

- Kerala has been hit mainly by 5 cyclones in the last 127 years.
- Cyclone TAUKTAE developed over the southeast Arabian Sea on 13th May 2021.
- It caused extremely heavy rainfall, strong winds and and tidal waves that affected Kerala from 14-15 May.

Death/injury

- A total of 11 people lost their lives due to falling trees and electric posts, lightning, drowning, and electric shocks.
- 22 people were severely injured and hospitalised.

Damage to homes/ property

- Over 500 houses in Chellanam (a coastal village) were completely destroyed.
- 80 schools were affected.

Flooding

- District of Kozhikode: 155 mm rainfall; Kannur: 147 mm of rainfall on May 16.
- Brought flash floods throughout the coast, especially in Chellanam.

Impact on agriculture

- Heavy rains, strong winds, flooding caused considerable damage to agriculture, especially of crops like rubber, banana, coconut, etc.
- Loss of 24433 hectares of perennial crop was due to the cyclone.

Impact on fishing industry

- Caused damage to boats, nets, fish farms.
- Total loss in the fisheries sector amounted to around 1,40,88,874 INR.

Disruption of power supply: many power lines snapped; Loss in power sector was estimated to be 21.44 crore INR.

WHY PEOPLE LIVE NEAR THE COAST

Explain why people live along a named area of coastline you have studied.
Content guide:

- Industrial development
- **Work in tourism industry**
- Ports/trade
- **Fishing**
- **Leisure activities/for surfers etc.**
- Fresh air/sea breeze
- Specified climate
- Moderating influence of sea on climate
- Peaceful/Retirement
- Scenic beauty
- Flat land/farming
- Ease of communications

Place specific reference: Named places along coast, Specific details of employment opportunities, Statistics, etc.

Jamaica

Work in tourism industry

- Tourism accounted for 15% of GDP in 2016.
- Tourism sector accounts for 60% of jobs.
- Tourism employs approx. 200,000 Jamaicans, directly & indirectly.

Industrial development; Ports/trade

- The mining industry in Jamaica accounts for around 4% of its GDP: The country is one of the world's largest producers of alumina and bauxite.
- Jamaica has a strategic location in the Caribbean Sea, due to its relative proximity to large markets in North America as well as emerging markets in Latin America.

Fishing

- Deep sea fishing is popular in Jamaica.
- Jamaica exported $13.5 million of fish and fish by-products in 2022.

Leisure activities

- Montego Bay has the best nightlife in Jamaica: it has beach bars, live music, bouncing clubs, and Margaritaville.
- Many Jamaicans are also into leisure activities like surfing, sailing, kayaking, etc.

Climate: Jamaica has warm climate all year-round, with the moderating influence of the sea.

Peaceful/Retirement

- Rent in Jamaica is around 70% lower than in United States
- The affordability of Jamaica makes it a popular spot for retirees.

Scenic beauty

- Montego Bay has some of the best beaches in Jamaica with scenic views. They are tranquil & ideal for relaxation/sunbathing.
- Blue Mountains are the longest mountain range in Jamaica, and offers hiking trails.

Flat land/farming

- Agriculture is the primary source of income for those in rural areas.
- The main export crops produced in Jamaica are sugar cane, bananas, coffee, cocoa.

CORAL REEFS

For a coral reef at a named location you have studied, describe its main features and explain its formation.
Content guide - Composition of coral - **Biodiversity** - **Locational features** - Deposition of calcium carbonate - Colonisation
For a named area you have studied, explain the conditions required for the formation of a coral reef.
Content guide - Warm Temperatures (17–33 degrees) - Oxygen - Depth of water (not more than 60 metres deep) - Sunlight - Food supply/Plankton - Sediment

- Salinity (30–38 parts per thousand) - Currents - Calm water
Locational details or named areas close to reef, Specific reference to species etc.

Great barrier reef

Features

- The Great Barrier Reef is the largest living structure on Earth.
- Its total area is about the same size as Japan or Italy, and is visible from space.

Composition: It consists of 3000 individual coral reefs.

Biodiversity

- It provides habitat for nearly 9,000 species of marine life; Each species plays a role in maintaining a healthy reef system.
- It also contains 400 types of coral.
- Vegetation in the Great Barrier Reef includes over 200,000 hectares of mangroves, and sea grasses.

Locational features: It is located in the Coral Sea (in the Pacific Ocean), off of the coast of Queensland, Australia.

Formation

- Coral animals floated around in the ocean attached themselves to rocks
- Coral animals build their skeleton, made from calcium carbonate in seawater.
- Over time, the skeletons of dead corals and shells become cemented together to form large deposits of limestone.
- Over time, the coral reef has been colonised by plants, sponges, etc.

Conditions required for formation

- **Sunlight:** Certain algae found in the reefs carry out photosynthesis to provide necessary nutrients needed for corals. This is why the reef developed only in shallow water where abundant sunlight reaches: GBR is 61 metres deep.
- Coral reefs require **warm sea temperatures**. GBR is 18- 27˚C. Even a slight increase in temperature kills algae and causes coral bleaching, and eventually leads to death.

- Sediment and other pollutants can smother coral reefs, lower water quality, and make corals more susceptible to disease. Therefore, coral reefs need **unpolluted water** that is free from sediment.
- Corals require **plenty of oxygen**. Lack of oxygen can kill reefs, by suffocation.
- Corals need food to survive, like all living creatures. Corals themselves produce sugars and oxygen to sustain themselves, but they also need plenty of **plankton** and other nutrients to help them stay healthy.
- They require **slow moving water**. Since a certain water temperature is essential for corals, proper water circulation is necessary. The ocean's natural current allows the water to stay at a balanced temperature year-round.
- Corals in lower pH waters tend to build thinner skeletons that are susceptible to damage from harsh waves or attacks by eroding organisms. Hence corals require **alkaline or neutral pH**.
- Coral need **salty water**, ranging from 32 to 42 parts per thousand. High salinity generally makes corals stronger.