



Coastal erosion

Causes, effects & mitigation

Learning Outcomes

1

S1 7: Demonstrate, using secondary data, the evidence for human-induced global warming (Data including: *precipitation levels* • atmospheric greenhouse gas levels • *rising sea levels* • historical testimony)

2

S1 9: describe how a chosen local ecosystem and human wellbeing are interdependent

3

S1 10: investigate the impact of an environmental factor on a chosen local ecosystem, gather and use primary data to support conclusions

- the impact of an environmental factor on at least one of the following in a local ecosystem: • air • soil • water • biodiversity

4

S2 1: discuss the concept of sustainable development

5

S2 6: compare how an innovative community in Ireland and an innovative community from the Global South are adapting to the effects of climate change

6

S3 6: outline what is meant by climate *change mitigation and adaptation*, climate debt, ecological debt, climate loss and damage

Tasks

Task 1: Engaging in dialogue about climate action and sustainable development

Task 2: Students research an instance where action has been taken to either address climate change and unsustainable development

Taks 3: students come to appreciate the interconnections between nature and people.

Task 4: effectively organise themselves to plan and design a potential action

4.1 Research and define a problem related to the issue

4.2 Identify the strategies and resources needed to address the problem

Project brief



Students will create a detailed proposal (in the form of a website or policy document) for a coastal mitigation and adaptation strategy tailored to their local area.



The primary goal is to assess potential hazards and propose realistic, evidence-based solutions.

Timeline

Introduction and Context

- Discuss key coastal hazards (erosion, storm surges, rising sea levels).
- Examine local geography using maps, fieldwork (if possible), and satellite imagery.

Researching European Case Studies

- students to research successful European coastal adaptation examples,
- A summary report or infographic comparing these strategies.

Create output

Week 1

Week 2

Week 3

Week 4

Final week (s)

Hazard Assessment

- Visit a local coastline to observe evidence of erosion, flooding, or damage.
- Collect data: photos, videos, sketches, and interviews with local stakeholders (e.g., fishermen, local authorities)
- A hazard map highlighting at-risk areas.

Proposal Development

- Gathering all data and combining information into 1st rough draft

Coffee seller who lost '500 customers a week' welcomes Bray-Greystones cliff walk taskforce

A 'sense of urgency must be applied', says community group. The taskforce 'must have a deadline'



NEWS • Election 24 Sport Entertainment Business Politics Regional Ireland Middle East Climate Nu

'Massive loss' as Wicklow cliff walk faces fourth summer closure

Updated / Saturday, 1 Jun 2024 19:44



Will Wicklow's Bray to Greystones Cliff Walk ever reopen?

After being closed for three years, Reporter Tom Galvin charts the Cliff Walk's demise and the efforts to save it as hope appears on the horizon





World ▾US ElectionBusiness ▾Markets ▾Sustainabi

Coastal erosion eats away at Irish family's 200-year-old home

By Clodagh Kilcoyne

October 18, 2024 6:00 PM GMT+1 · Updated a month ago

BALLYHEALY, Ireland, Oct 18 (Reuters) - An elderly Irish couple fear they are running their family home as accelerating coastal erosion brings the sea ever closer to their f

Willie and Lal Pierce have photos from around 30 years ago, showing two fields sepa

Escalating storms and extreme weather caused by climate change will increase coastal erosion with many Irish landmarks unable to be saved, experts say.

12.05am, 25 Feb 2024 ~ 20.5k

64 Comments [Share](#)



Storms adding to Ireland's coastal erosion problem

Updated / Saturday, 27 Jan 2024 18:10



Ireland's coastline

Approximately **25% of Ireland's** coast is at risk of coastal erosion

The west coast is characterised by major sedimentary areas in the form of large bays and estuaries

These areas are at risk due to the soft nature of the rock

Projected changes **in sea levels** increase in the **severity of coastal storms** is expected to exacerbate coastal erosion risk.

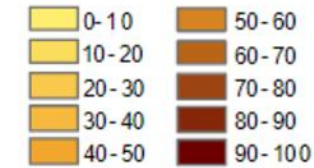
Ireland's coastal wetlands and soft sedimentary systems may be amongst the **first in Europe** to respond to storm-led sea level rise impacts.

Coastal erosion currently represents **a serious problem for Ireland**

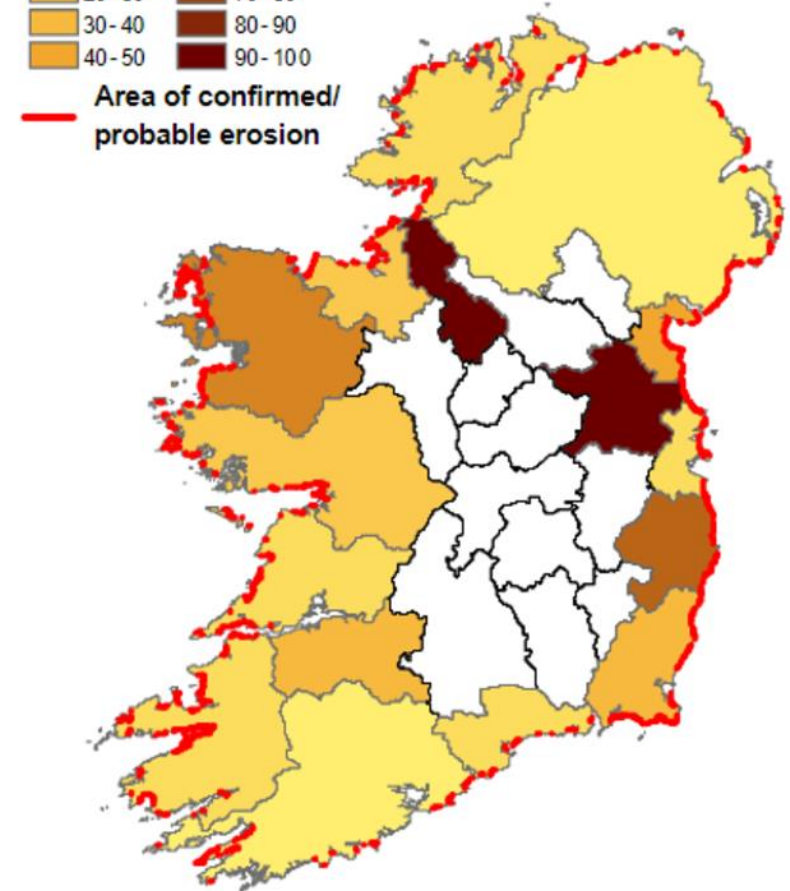
Urbanisation and economic activities in the coastal zone has turned coastal erosion from a natural phenomenon into an increasing problem

Current rates of erosion are at times reaching 2m per year

% Coastline per county deemed at risk of erosion



Area of confirmed/
probable erosion



Consider your local area



Using historic maps/
images **compare your**
coastline now and 100
years ago



What are **the key**
differences?



Has there been **any**
improvements?



What main
infrastructure (if any)
has **been impacted**
most?

Visible impacts

The effects of this erosion are visible as:

Rapid cliff retreat

On-land movement of dunes and other barriers

Loss of finer sediments (decreasing beach width)

'rock falls' or landslides

Factors influencing erosion

Composition:

- resistant vs non-resistant rock. Ireland's coast (where) is made of soft rock & sediment (proposing big issues) eroding faster

Wave strength:

- waves at their strongest during storms

Coastal shapes:

- coast that jut outwards more prone to erosion

Share gradient:

- steep sloping shores generate more destructive waves than gentle sloping. Steep shores cause waves to crash against the coastline

Human activity:

Can change the rate of erosion. Removing beach material can increase erosion, Building protective measures (sea walls, rock armour) can reduce it
(However, these constructions can exacerbate the problem of coastal erosion by impacting upon coastal processes.)

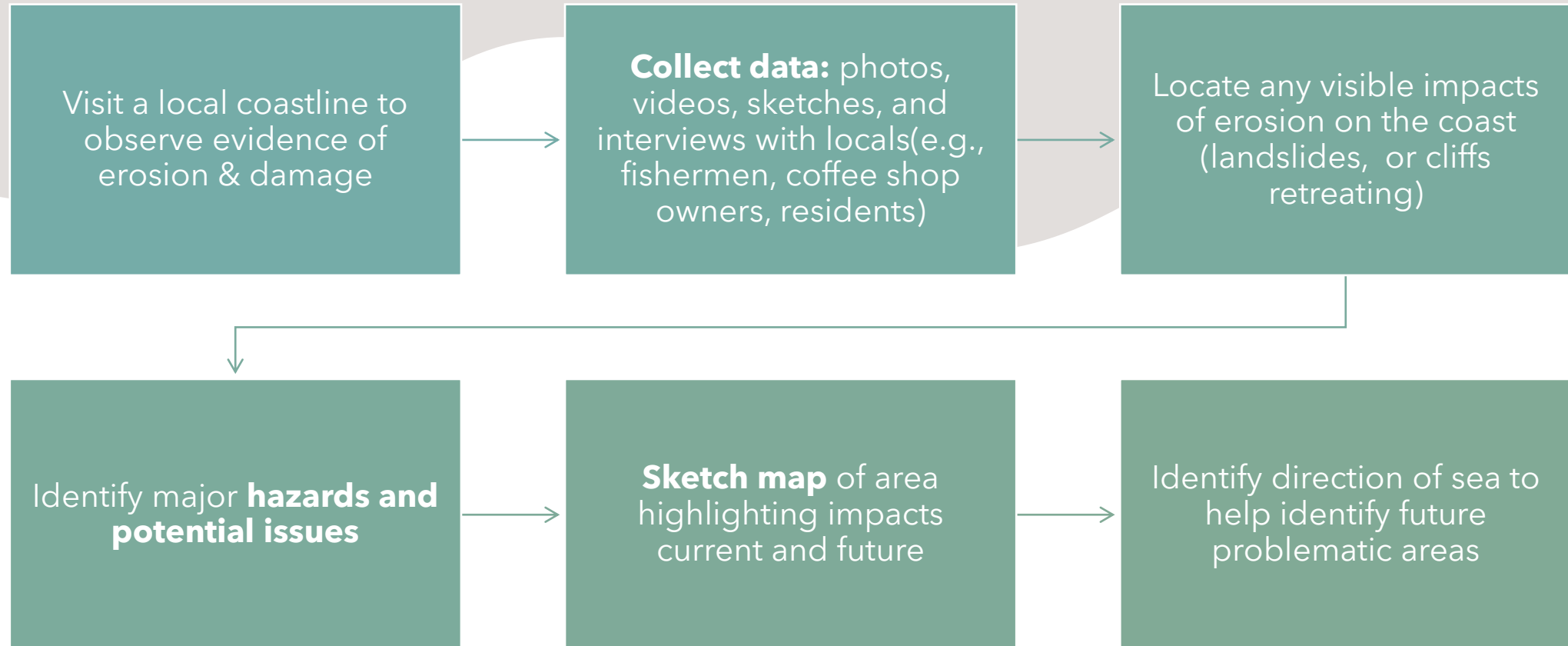
Rising sea levels:

- predicted seas around Ireland will increase by 30cm in the next 20years due to ice caps melting. Resulting in more flooding and more erosion along coasts

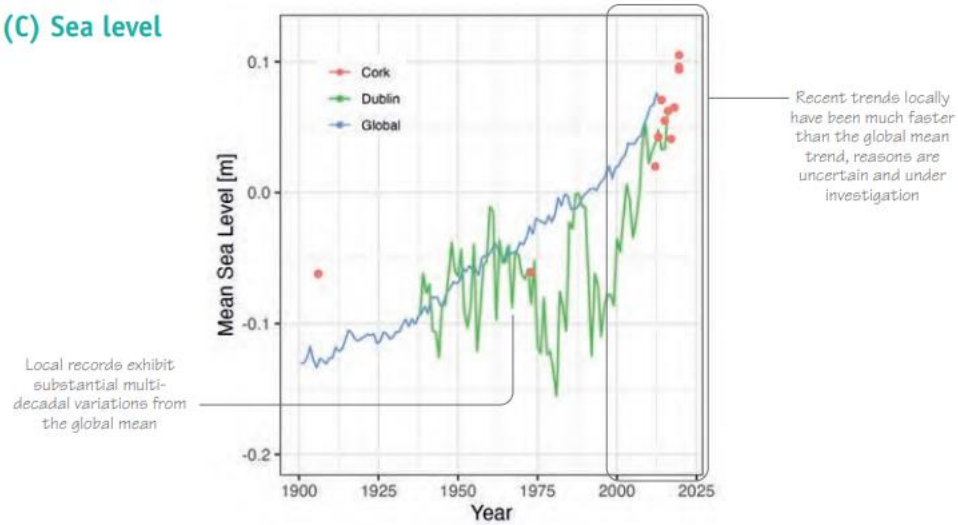
Climate change:

- increase in storm frequency and strength across Ireland is leading to increased erosion

Fieldtrip outline

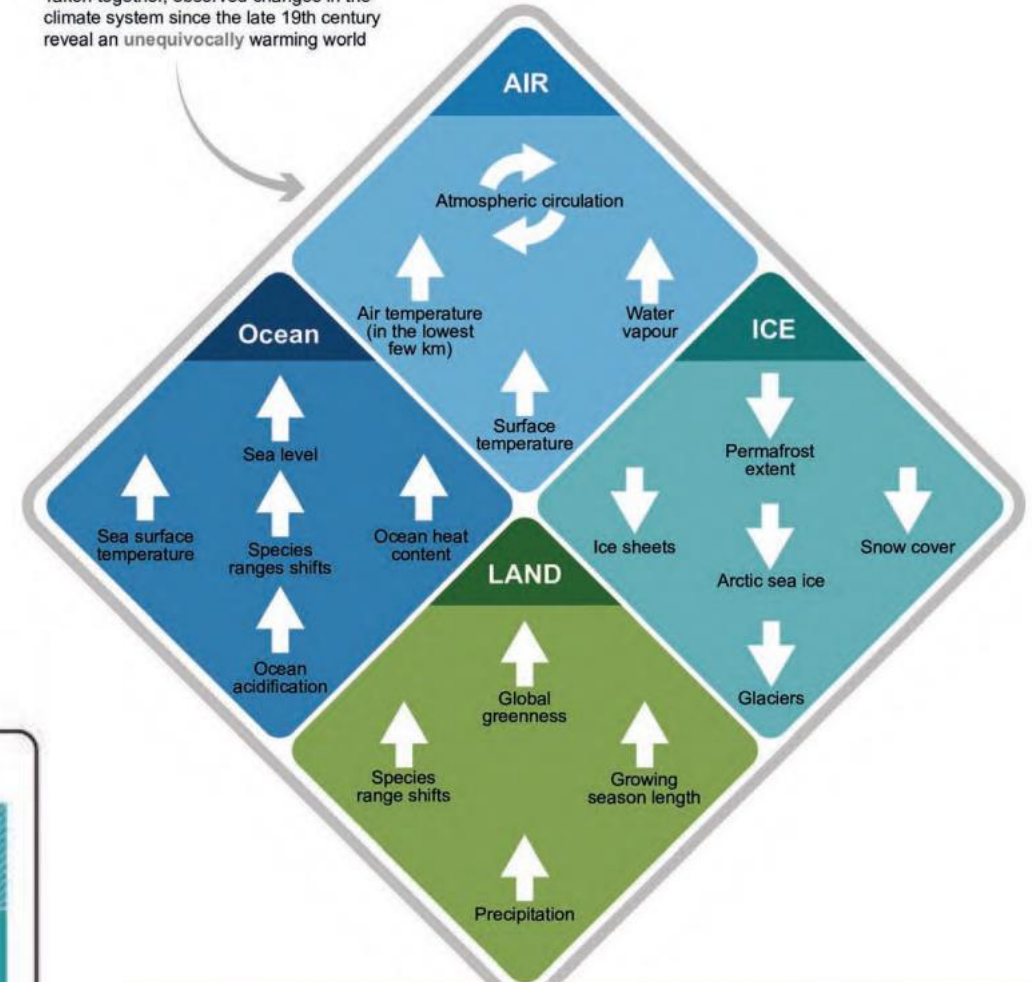


(C) Sea level



What is the evidence for climate change?

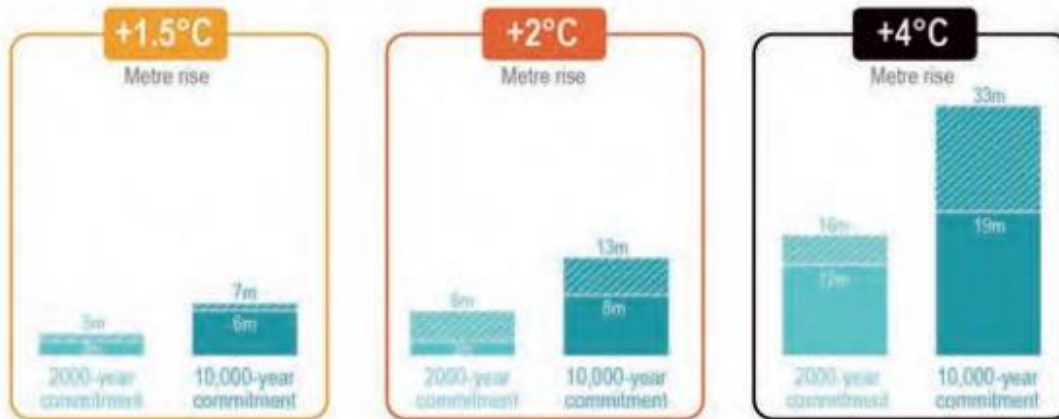
Taken together, observed changes in the climate system since the late 19th century reveal an unequivocally warming world

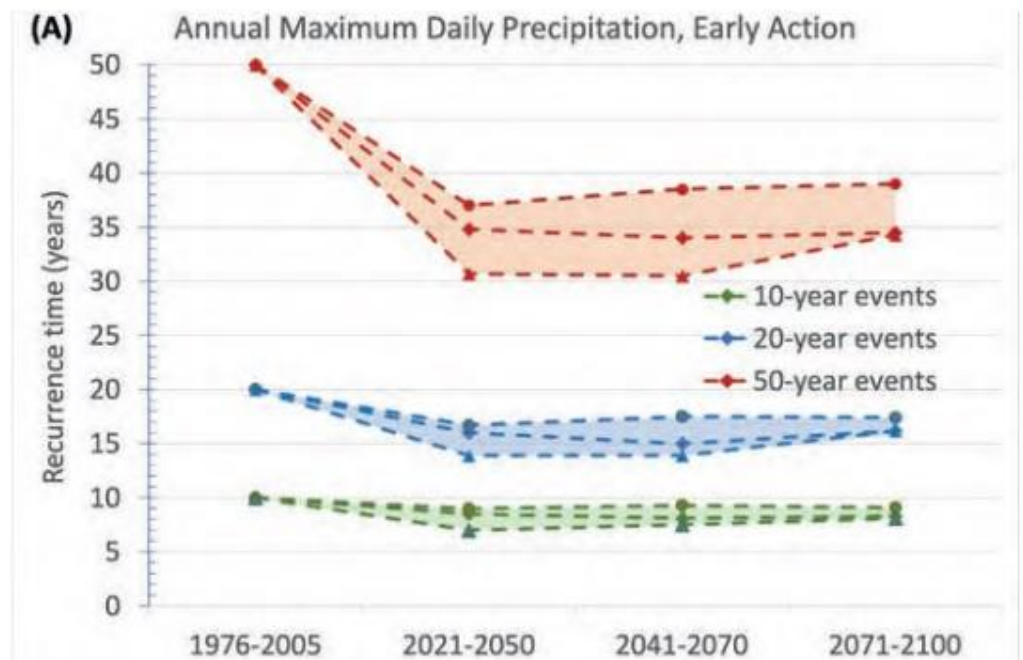
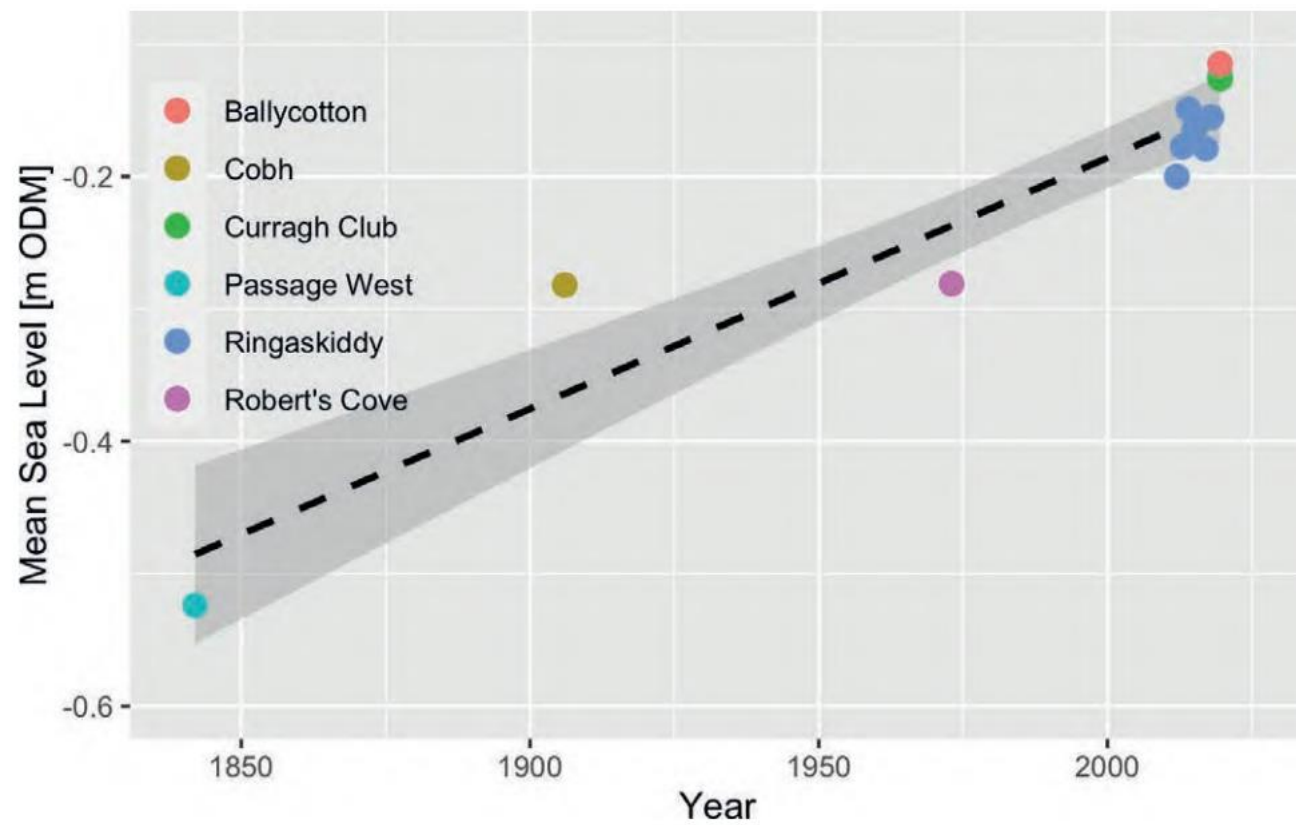


Long-term consequences: Sea level rise

Today, sea level has already increased by 20 cm and will increase an additional 30 cm to 1 m or more by 2100, depending on future emissions.

Sea level reacts very slowly to global warming so, once started, the rise continues for thousands of years.



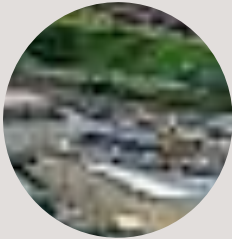


National recommendations

- | | |
|-----|--|
| 5.1 | Maintenance of coastal sensors and the national buoy network is essential for both national and global ocean monitoring. Ireland is also a member of the Euro-Argo programme and deploys Argo floats, which contribute to the global ocean monitoring network. Ireland's participation in such networks is crucial for gathering information on local and global ocean properties. |
| 5.2 | Currently, there is no long-term ocean current monitoring system being operated by Ireland. If such a system were to be put in place it would not only be key to understanding the seas around Ireland but also fill a large gap in the data for ocean currents in the North-east Atlantic. Such data would be extremely valuable for understanding the impacts of AMOC changes and variability in the Nordic and Atlantic seas. |
| 5.3 | Ongoing pCO ₂ and related measurements around the Irish coast from observatories and research vessels are necessary to help us build up a clearer picture of how different regions of the Irish coastal and shelf waters are contributing to, and responding to, carbon uptake from the atmosphere. |
| 5.4 | It is important that the current network of tide gauges is maintained and coordinated so that it meets the need for reliable, relevant and up-to-date information on sea level variability and change around Ireland on a sustained basis. |
| 5.5 | It would be beneficial to support research to collect, collate and digitise historical tide gauge observations to enable the reconstruction of longer-term changes around our coasts to place modern measurements in an appropriate longer-term context. |



Human interference with Coasts: Rosslare



Human interference began in 1860 when a viaduct was built between mainland and offshore pier

Effects:

Sediment was prevented from being transported further by longshore drift

Sedimentation occurred in the harbour

Dredging was needed to allow ferries and ships to sail in and out

Sediment was deposited further out at sea and not along the coastline causing beaches to become deprived of natural nourishment through deposition

1978 pier system developed, acting as a large groyne trapping sand

Reduced deposition has led to increased coastal retreat via erosion

2005 - 2012 15m of cliff retreated

Various coastal defence mechanisms have been introduced

Timber groynes & rock groynes to reduce erosion - this impacted the deposition processes meaning beaches further north began to shrink

Largest beach nourishment scheme ever carried out in Ireland. Sand was added back to the beach

Dredged from offshore

Sand dunes and marram grass also reshaped and planted

Coastal management

Hard structures: large structures made from resistant rock or concrete. They are permanent and are common along towns

Sea walls: concrete reinforced with steel. Curved walls to deflect waves backwards

Gabions: mesh cages filled with rocks to reduce energy of incoming waves

Rock armour: large boulders placed along coastline. Trap wave energy to reduce erosion and strength of waves



Soft structure: considered to be more environmentally friendly. Not permanent and are used to repair damage caused by destructive waves.

Beach nourishment: adding new sand to beaches which increases thickness of beaches. Expensive

Sand dunes: planting marram grass. Bind sand together

Strategies for medium to long term

Hold the line:

- These measures aim to **maintain the current position** of the shoreline and consist of hard engineering solutions. A hold the line policy is generally expensive and normally applied to protect valuable infrastructure and/or assets. Examples of a hold the line policy can be seen in the Netherlands

Retreat the line

- This strategy **allows for coastal recession** but on a managed basis will generally rely on an engineering measures. However, due to losses of land property, this strategy can be contentious. In contrast to land loss, this strategy can have some benefits such as the creation of salt marsh areas and other tourist attractions.

Advance the line:

- These measures aim to **push the shoreline forward** and is generally achieved through land reclamation and beach re-nourishment projects.

Do nothing:

- This involves **allowing the coastline to evolve** naturally and can be achieved through planning restrictions and setbacks. For example, no development can take place within a fixed distance to the coastline, e.g. 100m.

Project roles

Resident of the Local Area

A light blue downward-pointing arrow indicating a flow from the first role to the second.

Local Politician

A light green downward-pointing arrow indicating a flow from the second role to the third.

Environmentalist

A light green downward-pointing arrow indicating a flow from the third role to the fourth.

Council Worker

Outline of roles



Resident of the Local Area

Perspective: Represents the community's concerns and priorities, focusing on how the proposed solutions impact daily life and livelihoods.

Key Tasks:

- Gather local opinions through surveys or interviews with peers/family.
- Highlight social and economic challenges (e.g., how erosion affects homes or tourism)
- Propose community-friendly solutions.
- Create a section in the proposal about the **"Social and Economic Impact" of the strategy.**



Local Politician

Perspective: Focuses on policy, funding, and public accountability.

Key Tasks:

- Research potential funding sources (e.g., government grants, EU initiatives).
- Discuss how the plan aligns with local or national policy goals.
- Write a section on **"Feasibility and Funding"**, outlining costs and timelines.

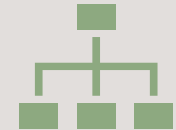


Environmentalist

Perspective: Advocates for environmentally sustainable and nature-based solutions.

Key Tasks:

- Identify nature-based strategies (e.g., dune restoration, planting vegetation).
- Ensure all proposed solutions minimise ecological impact and enhance biodiversity.
- Write the **"Environmental Benefits"** section of the proposal.
- Compare European examples of eco-friendly adaptation strategies and their success.



Council Worker

Perspective: Focuses on the technical and logistical aspects of implementing the plan.

Key Tasks:

- Conduct the **Hazard Assessment**, using maps, fieldwork data, and GIS tools.
- Highlight infrastructure needs (e.g., seawalls, drainage systems).
- Write a section on **"Implementation Challenges and Solutions"**, focusing on practical feasibility.
- Create or oversee the **Hazard Map** as part of the assessment.

Case studies

1. Venice, Italy: MOSE Project

Focus: Protect Venice from tidal flooding with mobile barriers.

Success: Prevented flooding during extreme high tides, but expensive to maintain.

2. Portugal

Focus: Hard and soft engineering strategies.

Beach nourishment through sediment redistribution & dune restoration.

Hard infrastructure including groynes and seawalls.

3. Barcelona, Spain

Focus: Sand dune restoration and artificial reef construction.

Success: Improved coastal resilience while maintaining tourism appeal.

4. France

Focus: Soft solutions, such as restoring wetlands.

Success: Reduced flood risk with minimal ecological impact.

Proposal structure

