



BRIEFING NOTE

No. 4

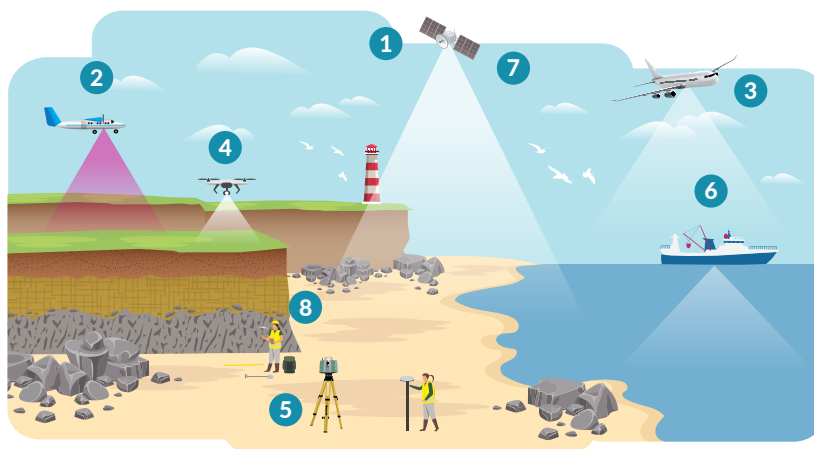
Geoscience Information on Coastal Change

Geological Survey Ireland Coastal Change

Geological Survey Ireland monitors and analyses changes to Ireland's coastline and combines oceanographic, hydrological and topographic information to anticipate how the coast may respond to future conditions. This information supports environmental, infrastructure, planning and coastal management decisions.

In 2016, 1.9 million people lived within 5 km of the coast in Ireland; of these 40,468 lived less than 100 m from the coastline¹. The effects of climate change and sea-level rise are already impacting coastal communities in many locations in Ireland. Geological Survey Ireland is monitoring the advance and retreat of land areas along the Irish coastline and identifying coastal vulnerability to the impacts of sea-level rise by using a combination of geological observation, remote sensing technologies, in-situ measurements and advanced desktop mapping techniques (Fig. 1).

Geological Survey Ireland is a member of the National Coastal Change Management Strategy Group, which is charged with developing an integrated, whole-of-government approach to coastal change. Geological Survey Ireland is producing information on coastal change that assists Local Authorities, Climate Action Regional Offices, the Office of Public Works and the Marine Institute. It also participates in the CHERISH Climate Change and Coastal Heritage project as part of the EU's Ireland Wales European Territorial Co-operation programme to analyse coastal heritage sites affected by climate change and coastal erosion.



The coastal environment is constantly evolving. Some geological conditions make the coast more susceptible to change. Coastal erosion is the process of wearing away material due to an imbalance in the supply and removal of material from a certain section, which can occur due to strong winds, intense rainfall, high waves and tides and storm surge conditions, resulting in coastline retreat. Assessing geological processes, resources and hazards on the coast and seabed is essential to understand how coasts are likely to change under future environmental and management scenarios.

Fig 1. Geological Survey Ireland uses a range of observation and remote sensing techniques to map the shore and seabed.

- 1 Satellite imagery.** The EU Copernicus Sentinel satellites provide regular, very detailed Earth observations from space that allow constant, close monitoring of changes to the coastline.
- 2 Airborne aerial photography.** Coastal changes can be mapped in detail using high-resolution photographic images taken at different times from airborne platforms such as drones and planes.

- 3 Airborne terrestrial and marine Lidar.** Laser technology provides very high-resolution and high-accuracy elevation models to be used in coastal mapping.
- 4 UAV Photogrammetry.** Photogrammetry techniques from Unmanned Aerial Vehicles (UAVs) are used to map short coastal segments in detail.
- 5 Land-based laser scanners.** These are used to map

stretches of the coastline, including infrastructure, vertical cliffs and dune systems.

- 6 Multibeam sonar boat surveys.** Multibeam bathymetry data, as delivered by the Geological Survey Ireland - Marine Institute INFOMAR programme, are the highest resolution datasets used in seabed mapping.

- 7 Global Navigation Satellite System surveys.** High accuracy remotely-sensed elevation data is used for a variety of coastal applications including coastal profiling and validation.
- 8 Traditional mapping techniques.** Field observations and measurements are made of Quaternary (subsoil) and bedrock exposures along coastlines.

Coastal Erosion Monitoring

Geological Survey Ireland is quantifying coastal change by calculating trends in erosion over time, connecting these changes to the underlying geology and evaluating other processes that shape coastal landscapes.

Rapid developments have occurred in remote-sensing technologies during the 21st century. Geological Survey Ireland is applying these technologies in innovative ways to advance understanding of coastal systems and their hazards. It participates in the European Space Agency's Coastal Erosion from Space project³, to develop innovative Earth observation products to support the assessment of coastal erosion. Geological Survey Ireland is also compiling maps showing the rate of erosion along the East coast of Ireland over the past 20 years, based on observations from space (Fig. 2). It plans to continue shoreline change monitoring around the rest of the Irish coastline.

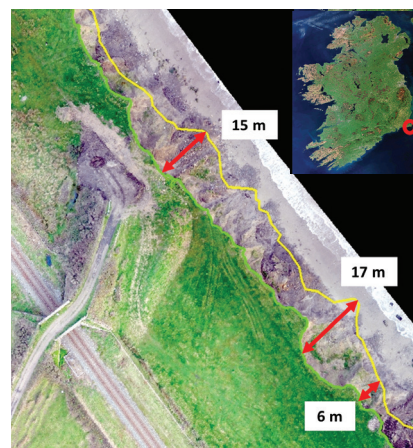


Fig 2. Coastal erosion (2014 to 2020) on the Rosslare coast mapped by GSI using remote sensing techniques. 2014 coastline in yellow, 2020 coastline in green.

Coastal Vulnerability Index mapping to evaluate impacts of sea-level rise

Negative effects of sea-level rise are now being felt by human and natural ecosystems, and these will continue for many years to come. The response of the coast to sea-level rise is not a straightforward process. Sea-level rises gradually and while this is happening, complex interactions among physical climate forces, geology, ocean processes and human activity influence how the coastline responds to the higher sea-levels.

Geological Survey Ireland has created a Coastal Vulnerability Index (CVI) to identify coastal areas that are more prone to erosion and retreat than others due to geological, coastal, climate and marine factors⁴. Maps showing the CVI for the Irish coastline (Fig. 3) provide an easy visual representation of sensitive areas and will enable all those who interact with the Irish coastline to prioritize or concentrate efforts on adaptation and make planning decisions to mitigate coastal change.

Geological Survey Ireland's data and maps are freely available via the web mapping services at www.gsi.ie.

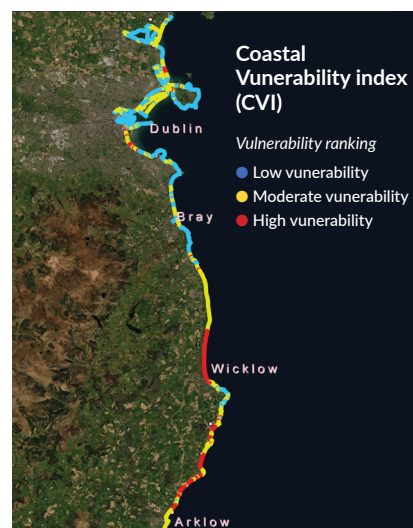


Fig 3. Example of a CVI in the pilot area on East Coast developed under research between GSI and Maynooth University⁵.



References

¹ Central Statistics Office (2021) Population Distribution 2016. <https://www.cso.ie/en/releasesandpublications/ep-p-cp2tc/cp2pdm/pd/>

² Geological Survey Ireland (2021) Marine and Coastal Unit. <https://www.gsi.ie/en-ie/programmes-and-projects/marine-and-coastal-unit/Pages/default.aspx>

³ Geological Survey Ireland (2021) ESA-GSI: Coastal Erosion from Space. <https://www.gsi.ie/en-ie/programmes-and-projects/marine-and-coastal-unit/projects/Pages/Coastal-Erosion-from-Space.aspx>

⁴ Geological Survey Ireland (2021) Coastal Vulnerability Index. <https://www.gsi.ie/en-ie/programmes-and-projects/marine-and-coastal-unit/projects/Pages/Coastal-Vulnerability-Index.aspx>

⁵ Caloca-Casado, S. (2018) Coastal vulnerability assessment of Co. Dublin and Co. Wicklow to impacts of sea-level rise. PhD thesis, National University of Ireland Maynooth.

Geological Survey Ireland,
Beggars Bush, Haddington Road,
Dublin D04 K7X4, Ireland.

Phone: 01 678 2896
Email: Duty.Geologist@gsi.ie

@GeolSurvIE
GeolSurvIE
geological-survey-ireland