GEOSCIENCE FOR LEAVING CERTIFICATE TEACHERS

Continuing Professional Development Course 2024

COASTAL EROSION

Shannon O'Brien (Temple Carrig), John Walsh and Shonny Lehane (both iCRAG, UCD)

iCRAG
RESEARCH IRELAND CENTRE FOR APPLIED GEOSCIENCES

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

Geoscience for Leaving Certificate Teachers CPD programme

About the Geoscience for Leaving Certificate Teachers CPD programme

Geoscience is vital for our sustainable future, and geography is the key gateway to geoscience for most students. Additionally, the new Climate Action and Sustainable Development (CASD) subject provides a brilliant opportunity to engage students with the geosciences through a new lens. The Geoscience for Teachers CPD programme has been developed by iCRAG and Geological Survey Ireland to create an opportunity for teachers of geography and CASD, and geoscience professionals to come together to increase the awareness of geoscience within the Leaving Certificate curriculum.

During the CPD course, teachers and geoscience professionals from both research and industry are paired together to co-create curriculum facing resources that are freely available for use. Over the course of six evening sessions, teachers learn more about the cutting-edge geoscience being undertaken by their partnered geoscientists, before working together to develop a curriculum-facing resource using their interests, teaching expertise and the knowledge of the geoscientist. In 2024, the resources produced have included lesson plans and module plans and the accompanying teacher notes and slides/activities for each resource.

The resources link the most recent advances in geoscience to the curriculum in a way that is both understandable and relevant. The resources are freely available to be used for classes anywhere in the world. We hope that you and your students enjoy using them.

This Resource

This resource has been developed by teacher Shannon O'Brien and geoscientists John Walsh and Shonny Lehane, both iCRAG at UCD. This resource is a deep dive into coastal erosion in a full module of engaging activity. Included in this resource pack is a full module plan and associated teacher notes, and a powerpoint of slides. It is suitable for Leaving Certificate students and potentially TY students.

Sincerely,

Elspeth Sinclair, Fergus McAuliffe, Siobhán Power
Programme Managers – Geoscience for Leaving Certificate Teachers

Geological Survey Ireland, a division of the Department of Environment, Climate and Communications, has been mapping Ireland since 1845. They continue to map the Irish land and marine territories, as well as mineral and groundwater resources. They have responsibility for actions in the current Climate Action Plan including monitoring coastal change, the Just Transition in the midland counties, and providing data for de-risking offshore renewable energy. Irish geoscience research, particularly as it contributes to the development of government policy, is an important part of their work and they fund and co-fund many research projects, including some of the iCRAG research work. Their data and maps are freely available to all at www.gsi.ie.

iCRAG is the Research Ireland Centre for Applied Geosciences hosted by University College Dublin.
We are a team of researchers creating solutions for a sustainable society.
We develop innovative science and technologies to better understand the Earth's past, present, and future and how people are connected to it.
We drive research in areas that are critical to society and the economy, including:

- Sustainable discovery of energy resources and raw materials required for decarbonisation.
- Securing and protecting groundwater and marine resources.
- Protecting society from Earth's hazards such as flooding and landslides.

The iCRAG Research Ireland Centre for Applied Geosciences hosted by UCD, comprises 150 researchers across ten universities and institutions. iCRAG is funded by Research Ireland, Geological Survey Ireland and industry partners.
Further information is available at: www.icrag-centre.org

Module plan: Coastal Erosion

Contents

Lesson plan:

Overview and Links to Curriculum

This project requires Climate Action and Sustainability senior cycle students to 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.

This unit of learning can also be adapted to be run as part of a TY Geography module, running the project over a longer period of time.

This project ties directly into Leaving Certificate Geography topics, particularly **Core Unit 1: Patterns and Processes in the Physical Environment**, with a focus on coastal processes and management. It also integrates various geographical investigation skills.

Timeframe: Six 1-hour classes (this can be adapted as needed for different year groups) *Note: This project can be adapted to suit any other local climate hazard (flooding etc...)*

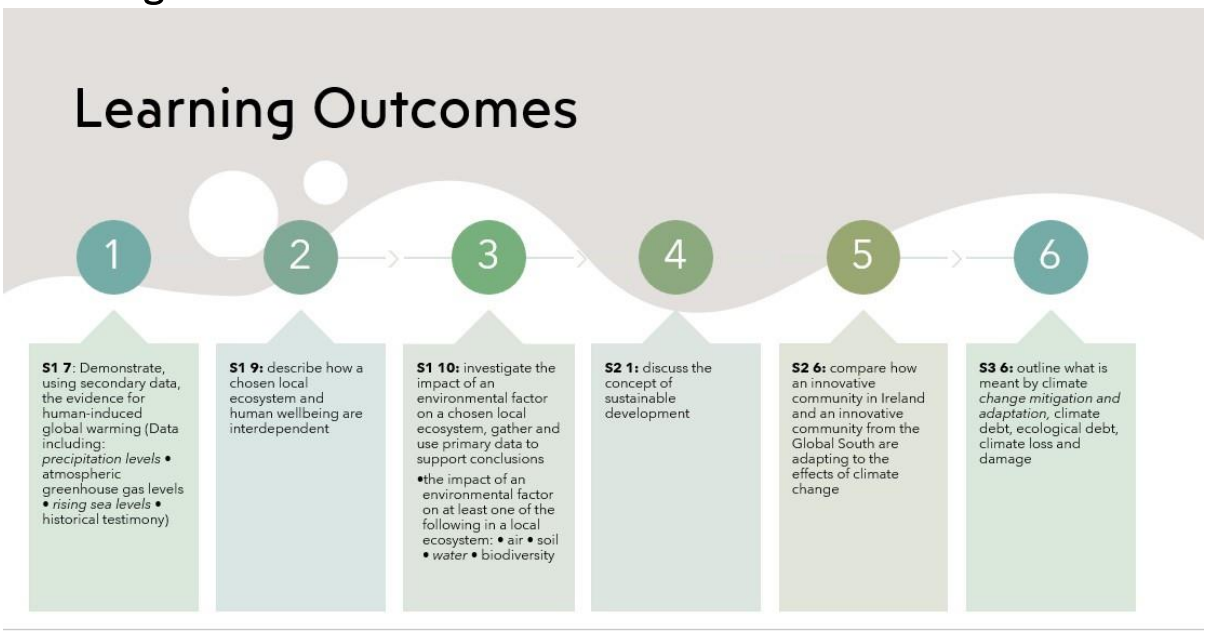
Skills Developed:

- Research and hazard assessment
- Critical thinking and problem-solving
- Proposal writing and communication
- Technological skills for creating websites/documents
- Teamwork (if done in groups)
- Literacy & numeracy

Learning Intentions

- **Understand** the causes and impacts of coastal hazards (e.g., erosion, flooding, sea-level rise).
- **Assess** the vulnerabilities of their local area.
- **Propose** feasible adaptation strategies to mitigate risks.
- **Evaluate** the success of coastal protection measures in other European regions and apply lessons learned.

Learning Outcomes



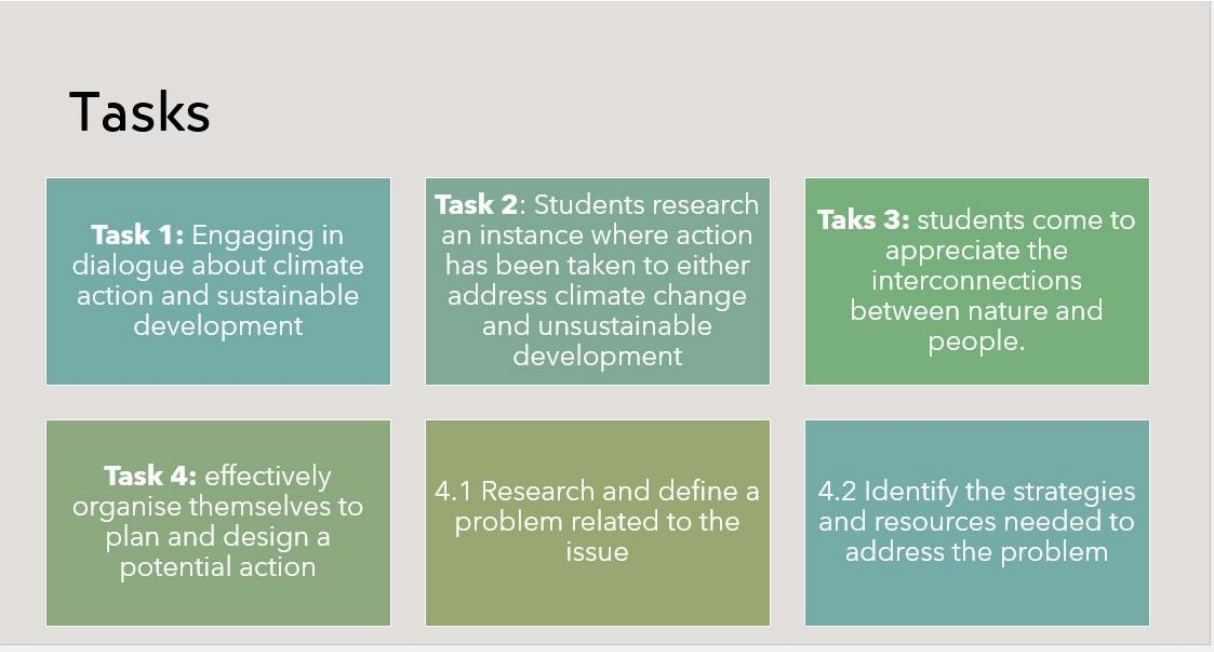
Linkage and Integration

Linkages

- English
- History
- Maths
- Biology
- Agricultural Science
- Economics
- Technology

Teacher Notes

This project incorporates areas from the tasks outlined below in the Leaving Certificate Climate Action and Sustainability course:



Roles:

1. Resident of the Local Area
2. Local Politician
3. Environmentalist
4. Council Worker

Role Breakdown and Tasks

Project Steps

The below weeks can be broken into as many classes as needed and be tailored to each year group.

Introduction and Context (Week 1)

Class Activity:

- Discuss key coastal hazards (erosion, storm surges, rising sea levels)
- Examine local area using maps and satellite imagery
- Compare historic maps to outline changes in coastlines
- Using media sources research local coastlines issues in the news
-

Research Component:

- Students identify their local area's primary coastal hazards
- Students research their local coast/ Irish coasts in the news
- Brief review of existing mitigation measures, if any
- Students brainstorm factors influencing coastal erosion

Hazard Assessment (Week 2)

Fieldwork class 4 (optional, based on logistics):

- 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).

Deliverable: Individual interview & sketch map of coastline

Desk-based Work:

- Use GIS tools (like Google Earth or ArcGIS) to map vulnerable areas.
- Analyse historical data: past storm events, erosion rates, etc.

- Council Worker: Leads the creation of a hazard map using GIS tools or fieldwork data.
- Resident: Documents the social and economic vulnerabilities identified during the assessment.

Deliverable: A hazard map highlighting at-risk areas.

See below for outline in creating map instructions

Researching European Case Studies (Week 3 class 6 & 7)

Assign students to research successful European coastal adaptation examples, such as:

- **Portugal**: Beach nourishment through sediment redistribution & dune restoration. Hard infrastructure including groynes and seawalls.
- **Venice, Italy – MOSE Project**: Mobile flood barriers to protect against rising sea levels.
- **Happisburgh, UK**: Managed retreat and community-led adaptation planning.
- **Barcelona, Spain**: Sand dune restoration to combat beach erosion.
- **Brest, France**: Nature-based solutions like planting seagrass for wave energy reduction.
-

Environmentalist: Identifies eco-friendly strategies used in European regions.
Local Politician: Investigates policy frameworks or government initiatives from these examples.
Whole Team: Summarise findings in a section of the website/document

Deliverable: A summary report or infographic comparing these strategies.

Proposal Development (Week 4)

Class activity

- Look at examples of current websites/ proposals for various Irish & European towns (see sources below)

Structure of the Proposal:

- Introduction: Description of the local area and identified hazards.
- Hazard Assessment: Use fieldwork and research data.
- Proposed Mitigation Strategies: Include hard engineering (e.g., sea walls), soft engineering (e.g., beach nourishment), and nature-based solutions (e.g., planting seagrass or building sand dunes).
- Cost and Feasibility: Estimate costs and suggest funding sources (local government, EU grants, etc.).
- Community Impact: Address how the plan benefits the community socially and economically

Resident: Social and economic impact of proposed strategies.
Local Politician: Feasibility, funding, and alignment with policy.
Environmentalist: Environmental benefits and nature-based solutions.
Council Worker: Hazard assessment, technical challenges, and implementation strategies.

5. Creating the Output (Final weeks)

Students choose between two formats:

1. **Website:**
   - Platforms: Wix, WordPress, or Google Sites.
   - Include interactive maps, videos from fieldwork, and links to European case studies.
2. **Policy Document:**

- Professional-style report with visuals (graphs, hazard maps, photos). Assign a lead for website design or document formatting based on group preference.

European Case Studies – Quick Details

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. **Happisburgh, UK**
   - Focus: Managed retreat from eroding cliffs.
   - Success: Reduced long-term costs and empowered local communities to adapt.

3. **Barcelona, Spain**
   - Focus: Sand dune restoration and artificial reef construction.
   - Success: Improved coastal resilience while maintaining tourism appeal.

4. **Brest, France**
   - Focus: Nature-based solutions, such as restoring wetlands.
   - Success: Reduced flood risk with minimal ecological impact.

Map creation:

Step 1: Collect Data

1. **Base Map:**

Using google maps or other interactive map platforms find your local area

2. **Hazard Data:**
   - Use the below stats to help identify areas of risk
   - **Sea Level Rise:** Use projections from the EPA or Climate Ireland.
   - **Flood Risk:** Overlay OPW flood maps from Floodinfo.ie.

3. **Community Inputs:**
   - Identify vulnerable zones (e.g., low-lying areas, eroding cliffs).
   - Highlight infrastructure at risk (e.g., roads, homes, or seawalls).
   - Mark areas affected by recent or historic events (floods, storm surges).
   - Historically impacted areas.

Use colour codes to represent different risks:

- Red: High risk (e.g., severe flood zones, eroding cliffs).
- Orange: Medium risk (e.g., periodic storm surge areas).
- Yellow: Low risk (e.g., mildly affected).

Highlight key findings for your project, such as:

- Specific areas requiring coastal defences.
- Locations where adaptation strategies should focus (e.g., dunes, barriers).

Extra information

The below sources can be used in the teaching of this unit. They are also linked with the PPT slides.
https://www.floodinfo.ie/

https://www.floodinfo.ie/map/coastal_map/

https://www.met.ie/climate/30-year-averages - data

https://coastal.climatecentral.org/map/12/6.1796/53.3063/?theme=sea_level_rise&map_type=year&basemap=roadmap&contiguous=true&elevation_model=best_available&forecast_year=2120&pathway=ssp3rcp70&percentile=p50&refresh=true&return_level=return_level_1&rl_model=gtsr&slr_model=i pcc_2021_med good map for projections but must flag the limitations!

Flood website example Adare: https://adarefrs.ie/

Arklow: proposal plan: https://www.floodinfo.ie/frs/en/arklow/home/

https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/ - helpful for initial project brainstorming

https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool - another projection

https://www.climateireland.ie/impact-on-ireland/climate-hazards/coastal-erosion/

https://www.coastal-management.eu/measure/public-education-schemes.html - good map for hazard assessment

https://impact.universityofgalway.ie/articles/global-sea-levels-are-rising-heres-what- we-can-do/
Really great resources for strategies

Publications
https://www.epa.ie/publications/research/climate-change/research-429.php

https://www.epa.ie/publications/research/climate-change/research-301.php