THE EFFECT OF HUMAN ACTIVITIES ON COASTLINES

CORE CONCEPTS

This resource enables learners to understand how natural- and human-induced climate change impacts sea level rise and environmental change. Understanding how ecosystems and past communities adapted to the impacts of natural climate change will help inform current and future adaptations to climate change. This resource also presents an opportunity to investigate how human impacts are directly affecting natural habitats and organisms in Wales, with a focus on plastic litter and how it affects seabirds.

STATEMENTS OF WHAT MATTERS LINKS:

SCIENCE AND TECHNOLOGY – The world around us is full of living things which depend on each other for survival.

HUMANITIES – Our natural world is diverse and dynamic, influenced by processes and human actions. The resource focuses specifically on concepts including interrelationships between humans and the natural world, cause and effect, change and continuity, physical processes and how living things interact with their environment.

This resource is intended for **progression step 4**, but could be adapted for use at other progression steps. The resource contributes to progression by focusing learning on the following descriptions of learning for this resource.

DESCRIPTIONS OF LEARNING

SCIENCE AND TECHNOLOGY: *I can describe the interdependence of organisms in ecosystems and explain how this affects their chances of survival.*

HUMANITIES: *I can understand and explain how human actions affect the physical processes that shape places, spaces, environments and landforms over time.*

I can understand and explain the range of factors that affect the interrelationships between humans and physical processes.

I can describe and explain how places, spaces, environments and landforms have changed over time and outline the processes that cause these changes in the natural world.

GUIDANCE

Human-induced climate change has huge impacts on our oceans, which has implications for coastlines. As global atmospheric temperatures rise, water in the ocean expands when it heats up, and melts the ice in polar regions, adding to the volume of water in the sea. This means that sea level is rising by approximately 3.8mm per year in Wales, and in the last 30 years, sea levels have risen by 10cm, according to the Ordnance Survey. Whilst this doesn't seem like a lot, when added to a high tide or storm state has the potential to overwhelm current sea defences and have a greater impact on natural barriers and coastal margins.

As a result of seawater flooding the land, the soil on farmland can become contaminated with salt making it unsuitable for certain crops. The salt water can also contaminate underground stores of fresh water (aquifers), which may be important locally for irrigation and animal drinking water. Smaller harvests can lead to higher food prices or reduced profits for producers. Land susceptible to flooding has a lower value because of the limited time it is available for use and a reduction in the range of uses it can be put to. This has a negative economic impact on the landowner and communities.

Changing landscapes also have an impact on the ecology of an area and the organisms that live there. This resource explores fundamental concepts in ecology and further explores how natural and human-induced climate change can alter the affect organisms living in an ecosystem.

SUGGESTED ACTIVITIES

1. Research the ecological changes that occur in a freshwater ecosystem that is inundated with sea water. Describe and explain how this might affect the plants and animals living in this habitat. Suggest how hunter gatherers may have changed the way they used Llyn Maelog after it was inundated by the sea.

2. Study a food web and define what is meant by 'interdependence'. Using a ball of string, with each pupil being a different species in the food web, show the connection between every living thing. Ask one of the pupils to move the string (indicating that the population is decreasing), anyone who detects the movement will be considered affected by that species.

3. Discuss the challenges that past human communities may have faced through living on Grassholm.

4. Study the picture of the gannet population of Grassholm island and discuss the potential impact of plastic on the gannet population.

5. Create a wall display to demonstrate Wales' seabird population (https://www.wtwales.org/wildlife-explorer/birds/seabirds). You could focus on one species or showcase a few. Investigate how human activities are affecting sea bird populations in Wales, and describe what conservation efforts are required to protect their numbers.

SEA LEVEL RISE AND CHANGING LANDSCAPES IN THE PAST

Rhosneigr is a small village on the southwest coast of Anglesey. Below the village is a 20-hectare lake known as Llyn Maelog, which is separated from the beach by sand dunes that rise to about 20m high. The lake is a significant ecological habitat for a range of plants, birds and animals, but is also an important focal point for residents and tourists alike.

Once the ice retreated after the last Ice Age (15,000 years ago), it left behind Llyn Maelog, a freshwater lake that was much larger than it is today. We also know that the sea level was lower, with the coastline about 1km further away than its current location. Near Llyn Maelog is Llyn Cerrig Bach, Barclodiad Y Gawres, Bryn Celli Ddu Burial Chamber and other Mesolithic sites which indicate that the lake was nestled within an important prehistoric site. Hunter gatherers roaming the land 8,000 years ago may have used the lake as a source of freshwater, a site for hunting and fishing, or religious rituals.

Due to the warmer climate, glacier ice was melting and increasing sea levels. About 7,000 years ago, the sea breached the bank of Llyn Maelog and salt water infiltrated the freshwater lake, completely changing the ecology. For most organisms, this environmental change would have been too quick to adapt to, and Mesolithic people would have had to change the way they used the lake. Over the next thousand years, coastal processes formed a barrier in front of the lake. Research has shown us that in 4000 BC (about 6,000 years ago), a woodland was growing in front of the lake, on the site of where the beach is today. This woodland barrier cut the lake off from the sea, so it was able to re-establish as a freshwater lake as it is today.

An aerial image of Llyn Maelog, Anglesey. A dune complex can be seen between the beach and the lake.

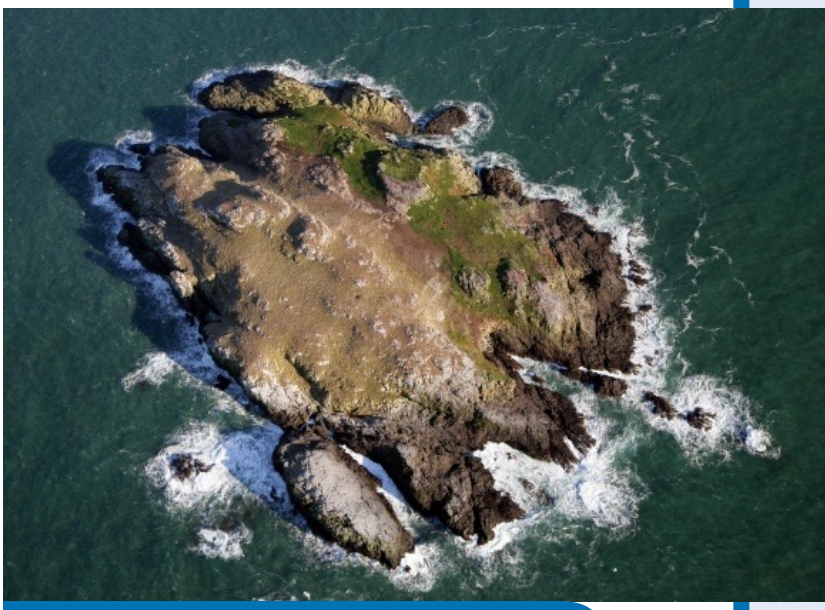
ECOSYSTEMS

KEY TERMS

Species	An organism that can reproduce with another organism to produce fertile offspring.
Population	Total number of organisms of a species within an area
Interdependence	When the organisms in an ecosystem depend upon each other for survival. If the population of one species is affected, this will affect the population of the species that relies on it.
Competition	Then the organisms within an ecosystem compete for resources.
Producer	Organisms at the base of a food chain which photosynthesise. They convert energy from the sun into sugar (glucose) which produces biomass.
Consumer	Animals that consume producers are known as consumers.
Decomposers	Microorganisms (such as bacteria and fungi) that breakdown dead organisms and recycle the nutrients.
Herbivores	Animals that only consume plants.
Omnivores	Animals that consume plants and animals.

HUMAN-INDUCED IMPACTS ON THE COASTLINE

Grassholm island in Pembrokeshire is home to the worlds' third largest colony of gannets (a type of seabird). As a result of the growth of the gannet colony on Grassholm coupled with the way they build their nests, the vegetation on the island is reducing. This is revealing archaeology of people who once lived on these islands. It is known that Bronze and Iron Age, and medieval people settled here. The archaeological evidence that remains includes rectangular structures, stone field boundaries demonstrating that people lived and farmed on Grassholm. The island is 6 miles from the coast of Wales, which would have made the communities living here very isolated. It was abandoned at some point during the medieval period, perhaps due to a harsher climate, making life on the island very difficult.



Grassholm island on the Pembrokehsire coast. It is home to 39 000 pairs of gannets!

A changing climate and landscape mean that people must either adapt to their new environment or find somewhere else to live. We know that living with change has been part of our ancestors' lives, just like it is happening to communities today and future communities. On top of natural climate and landscape change, we have human induce climate change, accelerating environment and landscape change. This means that organisms don't have the opportunity to adapt quickly enough to changing ecosystems, which impacts biodiversity and perpetuates the issues associated with climate change. In addition to a changing climate, factors such as plastic debris is severely impacting our coastlines, and for one case, is impacting the gannet population of Grassholm.

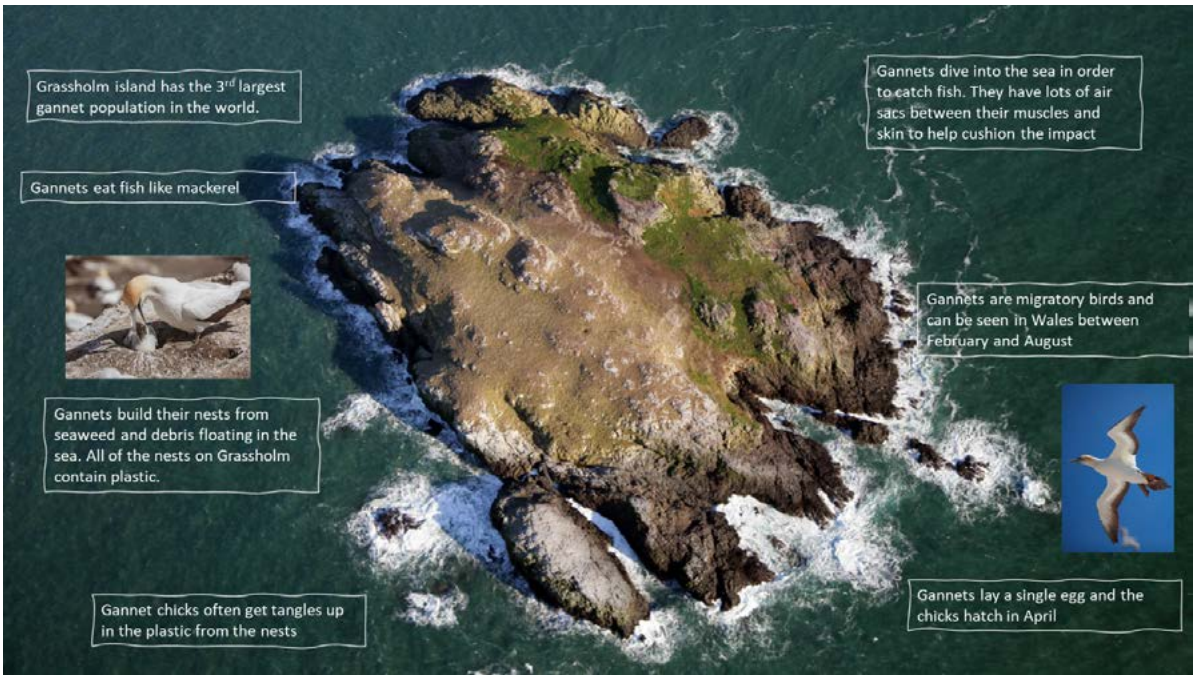
A picture demonstrating the extent of the plastic pollution on Grasshom island. The plastic has been transported there from the sea and seashore by the gannets to build their nests with.

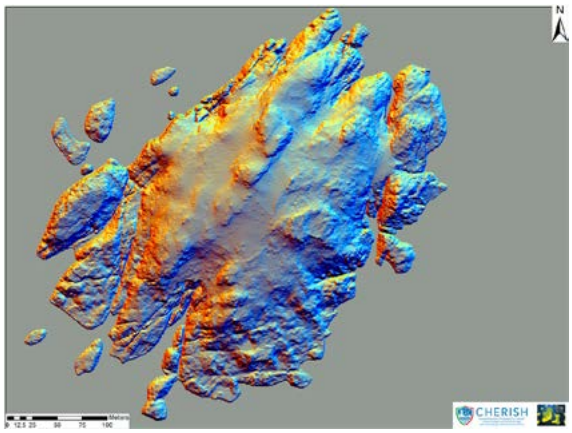
Gannets are migrating birds and can be seen on the coast of Wales between February and August. They build big nests, which are mainly comprised of guano (bird poo) mixed with seaweed, grass, and any plastic they find floating in the sea. Gannets hunt by flying up high and circling around, looking out for shoals of fish such as herring or mackerel. Once their binocular vision catches sight of their prey, they dive into the sea up to a few meters. They use their wings and feet to propel them deeper (up to 30m). These incredible birds are under threat from plastic debris. The chicks often get tangled up and they won't make it to adulthood.

Credit: Georg Wietschorke

An image of a gannet with plastic debris in its beak.

EXAMPLE SEABIRD WALL DISPLAY





This image was created using LiDAR data. LiDAR stands for Light detection and ranging, which is a technology that creates high-resolution models of the ground and how elevated it is. LiDAR data can be used on Grassholm show how the landscape, vegetation and sea bird population is changing.

The little mounds appearing in this photograph show the gannet nests on Grassholm. They are made of guano (bird poo) and plastic debris. The smell of the guano is overpowering on the island, and there is so much of it that is burns off the grass and exposes the archaeology beneath it. The archaeology being exposed is now more vulnerable to erosion and destruction.

CHERISH
Newid Hinsawdd a Threftadaeth yr Arfordir
Climate Change and Coastal Heritage
Athrú Aeráide agus Oidhreacht Chultúrtha

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