



EVIDENCE FOR PAST CLIMATE CHANGE

CORE CONCEPTS

This resource encourages learners to understand how climate change occurs through natural and human induced processes. It focusses mainly on past climate change, and the evidence that we have for a changing climate over time. By using this resource, learners can review evidence to evaluate the interpretation of past climate and make judgements on the significance of documenting weather patterns.



STATEMENTS OF WHAT MATTERS LINKS:

HUMANITIES – The resource enables learners to enquire, explore and investigate to inspire curiosity about the world in the past; engage with their understanding that the natural world is diverse and dynamic, influenced by natural processes and human actions. It focuses specifically on concepts relating to evidence, judgement, cause and effect, interrelationships between humans and the natural world, change and physical processes.



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

HUMANITIES: *I can analyse the usefulness and consider the reliability and validity of a range of evidence relating to my enquiry.*

I can draw considered and reasoned conclusions to my enquiries, while understanding that other people may form different conclusions from the available evidence.

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

LITERACY AND COMMUNICATION: *I can listen empathetically to different people's viewpoints on various subjects, using them to arrive at my own conclusions.*

GUIDANCE

Understanding the climate of a particular area is fundamental to adapting to living with our weather patterns. Climate is the general weather over a long period of time (such as 30 years), whereas weather is the conditions of the atmosphere over hours or days. Understanding how climates changed in the past helps us to understand weather patterns and why they change. It also informs us of how past societies

have had to adapt to a changing climate. By reviewing written evidence, we can start to build up a picture of how climates changed in the past. This resource contains various pieces of evidence that learners can review and evaluate to reach their own judgements.

The pages at the end of the resource can be printed and used for the suggested activities.



SUGGESTED ACTIVITIES

- 1 Describe the climate in your area. Describe the influence of seasons, and average weather patterns. [Met Office Welsh climate](#) – a Met office resource that discusses, in detail, Wales' climate.

Explore extreme weather events in Wales, and how this has impacted society through damage to infrastructure, public health, agriculture and the economy. Examples of extreme weather events include The Beast from the East of 2018 and the drought in the summer of 2022).

- 2 Study the articles written about past storms in Newgale and Newborough. Discuss as a class or conduct a written task to answer the following questions: What are the events described? What are the effects of the events? How would the landscape change have affected people?
- 3 Pupils could write a descriptive account of a storm that they remember experiencing, or a take an account of a significant storm that a family member experienced.
- 4 Compare the painting of Cwm Yr Eglwys from the 18th century verses the image from 2019. Discuss the differences and similarities between the images. You could use this as an opportunity to comment on the accuracy of the painting and whether it can be used as an historical artefact.



Comisiwn Brenhinol
Henebion Cymru
Royal Commission on the Ancient
and Historical Monuments of Wales

WHAT CAUSES CLIMATE TO CHANGE NATURALLY?

Climate change has always occurred naturally throughout the history of the Earth. Through a combination of the causes below, the Earth cycles through ice ages and warmer periods.

Cause	Meaning	Impact
Strength of the sun	When the Sun's energy passes through space and the Earth's atmosphere, some of the energy is reflected into space, and some is absorbed by the Earth	Changes in the amount of energy received from the sun
Changes in Earth's orbit, axial tilt, and precession (Milankovitch cycles)	<p>Orbit – The Earth's orbit around the sun is an ellipse, but the shape of the ellipse can vary (every 112,000 years). As a result, the Earth can move closer and further away from the Sun.</p> <p>Axial tilt – The tilt in the axis of the Earth changes with time (over approx. 41 000 years).</p> <p>Precession – When the Earth wobbles on its axis, and the poles point to different parts of the sky (approximately every 26,000 years).</p>	<p>Orbit – Affects the length of Earth's seasons and whether it is colder or warmer on Earth.</p> <p>Axial tilt – The greater the Earth's axial tilt, the more extreme our seasons are. As the angle increases, the summers are warmer, and the winters are cooler.</p> <p>Precession – Affects the extremities of seasons. Currently, the Northern hemisphere is closer to the sun during winter, so winters are less extreme, whilst the Southern Hemisphere is closer to the sun in the summer, making their summers hotter.</p>
Quantity of greenhouse gases in the atmosphere	Greenhouse gases include gases such as Carbon dioxide, methane, nitrous oxide, ozone, and water vapour. The more greenhouse gases in the atmosphere, the more energy from the Sun is trapped within our atmosphere. Since the industrial revolution, humans have had a big impact on the quantity of greenhouse gases in the atmosphere.	The more trapped energy from the Sun, the warmer the climate, globally.
Ocean currents	<p>Ocean currents transport warm water around the Earth (like a conveyor belt).</p> <p>As oceans absorb more heat from the atmosphere, sea surface temperature increases, and the circulation patterns change.</p>	Increased sea surface temperature can result in more precipitation (rainfall) and increased water vapour in the atmosphere (a greenhouse gas). In regions near the equator this process drives the development of cyclones and hurricanes.
Plate tectonics	Tectonic plates cause land mass to move creating mountain ranges and trenches.	Mountains can change the circulation and weather patterns on the Earth.
Volcanic eruptions	Volcanic eruptions throw gases and particles into the Earth's atmosphere.	Gases and particles in the atmosphere contribute to the warming and cooling of the Earth.
Changes in land cover	<p>Vegetation and algae absorb carbon dioxide, whilst desertification release carbon dioxide through a reduction in vegetation.</p> <p>Areas of land without vegetation (such as ice sheets) also reflect larger amounts of the Sun's radiation. This is known as Albedo.</p>	<p>Increased vegetation removes carbon dioxide from the atmosphere (reducing the amount of greenhouse gases).</p> <p>Albedo – Larger areas of bare land increase reflection of the sun's energy and has a local cooling effect.</p>

HOW DID BRONZE AGE COMMUNITIES CHANGE THEIR ENVIRONMENT?

Before the first farmers, most of Britain was covered in trees, also known as wildwood. Clearance of woodland started at the start of the neolithic period, when the first farmers required areas of deforested land to rear animals and grow crops. During the Bronze Age, huge areas of woodlands were being cleared for settlements, farmland and timber, and the clearance continued well into the Iron Age and beyond. The development of metals tools enabled tree clearance to accelerate, and by 500 BC, it is estimated that 50% of the wildwood had gone. By 1000AD, the area of woodland remaining in Britain had dropped to 20%, which is not dissimilar to the coverage of trees we have now. It is amazing to think that woodland management was so extensive and began well before even iron was discovered.

The areas of woodland that were left, were well managed. Oak and ash would have been used for building materials; alder, hornbeam and sweet chestnut make good charcoal; hazel was coppiced for making houses, fences and baskets; willow is a good weaving wood.

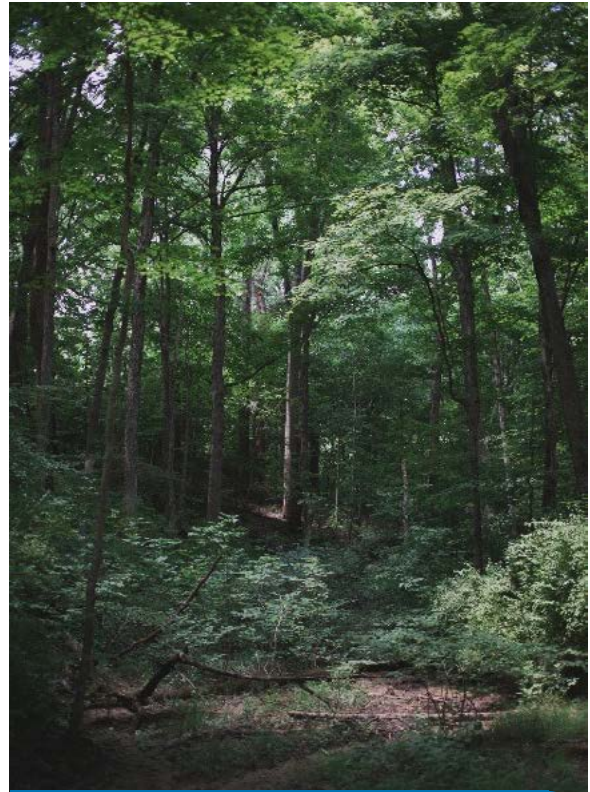


Image of a mature temperate woodland.



The image above shows areas of land that have been cleared of woodland.

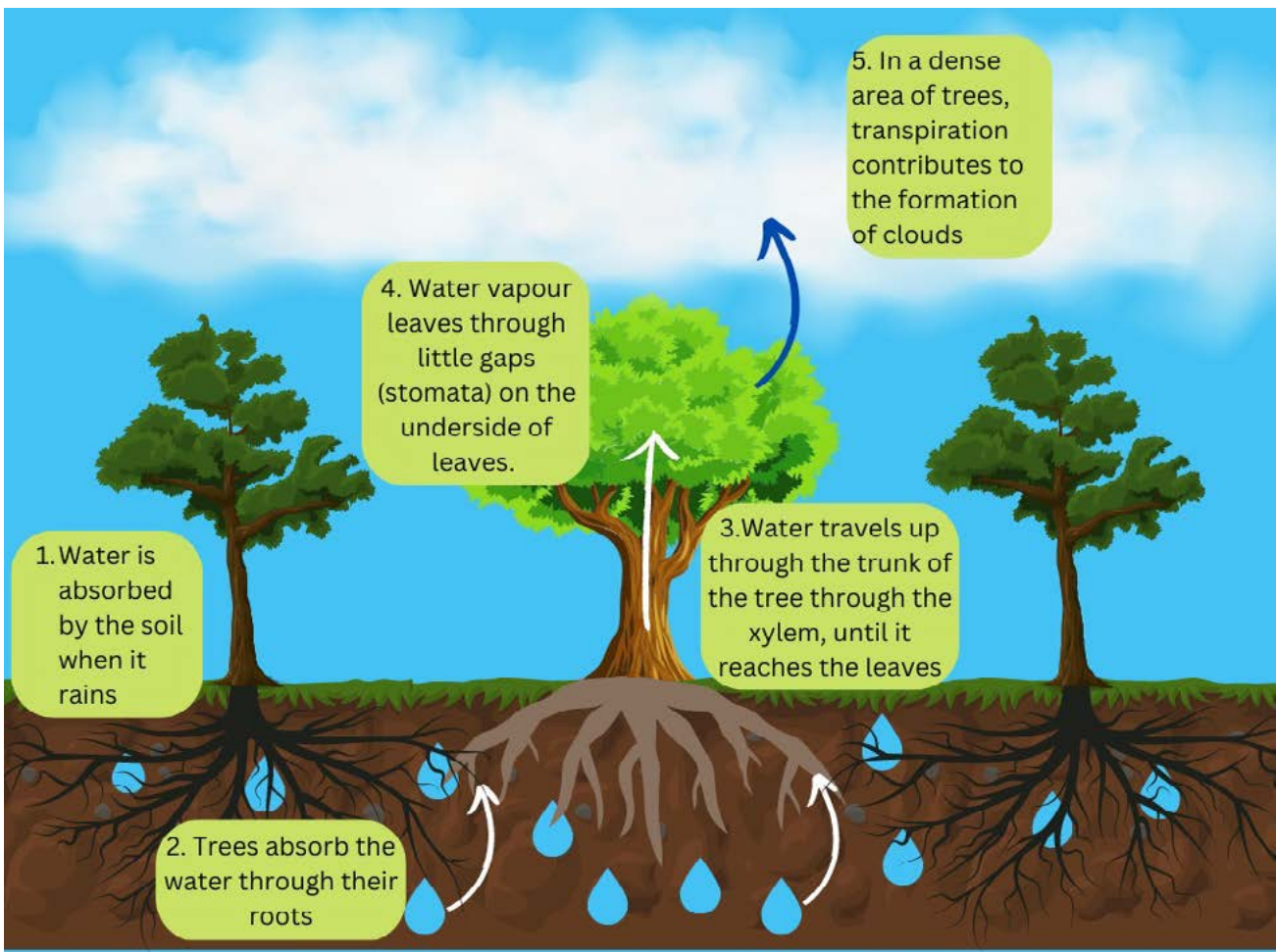
We often think of the industrial revolution as the starting point to human induced climate change, but arguably, the impact of humans on the Earth started at least 3000 years before that.

“ ...to convert millions of acres of wildwood into farmland was unquestionably the greatest achievement of any of our ancestors ”

Rackham, 2000

TRANSPIRATION

Vegetation, and in particular trees, have a local effect on rainfall. Plants undergo a process called transpiration, which is when water is drawn up through the stem of the plant from the soil. On the underside of leaves, little gaps called stomata are opened and closed by guard cells, which allows gases into and out of the leaf. As a result, some water vapour is lost through the stomata, particularly when there is wind, the temperature is high, and the humidity is low. This water vapour in large quantities creates clouds, which in turn falls as rain (like a [temperate rainforest](#)). It is difficult to imagine that Wales may have once been covered in so many trees, that they would have affected the weather so significantly. When the water vapour evaporates, thermal energy is stored within the raindrop, which has a cooling effect on the surrounding environment. Additionally, trees provide shade from the sun which reduces the temperature of the surrounding environment.



The process of transpiration where trees contribute to the formation of clouds.

HOW PAST EXTREME WEATHER EVENTS HAS SHAPED THE LAND

We have evidence of more recent changes in past weather and climate through historical accounts written by people. Only the educated people could read and write, which comprised only about 5% of the population. Educated people tended to be monks, and only wealthy boys were educated. The medieval documents that have survived include religious text (Bibles) and record land ownership, dispute resolutions, payment of money and rights and responsibilities of people. Monks often travelled to carry out their religious duties and would write accounts of their observations about the places they went to. Below, there are two accounts written by clergymen about two different storms.

“ The wind blew with such unprecedented violence that the shores of South Wales were completely denuded of sand... the seashore took on the appearance of a forest grove, cut down at the time of the Flood... The tempest raged so fiercely that congereels and many other fish were driven up on the high rocks...

Giraldus Cambrensis describing storm impacts at Newgale, Pembrokeshire during the winter of 1171/2.

On the feast of St Nicholas (December 6th), 186 acres were destroyed so thoroughly by the sea and the inflow of sand as to render it useless for agriculture evermore ... At the ebb tide the sand on the shore dried in the strong wind and got blown inland well beyond the high water mark as there was no cliff or rock to hinder it. Many families were driven out of their crofts into the town of Newborough from land between Llanddwyn and Newbororugh.”

**Bishop of Bangor, Hanes plwyf Niwbwrch ym Môn.
Hugh Owen MA FSA storm of 1331.**

Other evidence we have of past climatic events include artwork. To the right is a drawing by H Gastineau (c 1825) of Cwm Yr Eglwys, Pembrokeshire, and below is a photograph of the same beach from 2022. During the storms of 1850, 1851 and 1859, the church at Cwm Yr Eglwys was destroyed, and the village was later protected by a sea wall that was built to reduce the effects of rising sea levels and storm damage. Comparing these two images, helps us determine how the landscape has changed. Most strikingly, we can see what's left of the church, and how the configuration of the land has appeared to change. This is where it is important to consider the accuracy of Gastineau's painting.



Cwm-yr-Eglwys; Henry Gastineau, 1830



Cwm-yr-Eglwys; 2022

CWM-YR-EGLWYS; HENRY GASTINEAU, 1830

