



3C's of climate change

The aim of this information note is to support the 3 C's of climate change activity and aid discussion on the causes, consequences and combatting of climate change.

Causes of climate change

<p>Fossil fuels</p>	<p>Fossil fuels include peat, coal, oil and natural gas and are non-renewable sources of energy (or very slowly renewable in the case of peat).</p> <p>Fossil fuels are made up mainly of carbon and they release carbon dioxide when they are burned (used), which adds to the greenhouse effect and increases global warming.</p> <p>Most of the products we use at home, work or school, need power such as electricity to work. A lot of this power comes from burning fossil fuels. The more fuels that are burnt, the more carbon dioxide is released into the atmosphere.</p>
<p>Deforestation</p>	<p>Deforestation is the cutting down and removing all or most of the trees in a forest.</p> <p>Plants absorb carbon dioxide from the atmosphere during photosynthesis and so forests play a huge role in the carbon cycle on our planet. When forests are cut down, not only does carbon absorption cease, but the ground disturbance can lead to the loss of carbon from the soil. If the wood is burned, or even if it is left to decompose after the deforestation process, the carbon stored in the trees is released into the atmosphere as carbon dioxide.</p> <p>As well as the destruction of a habitat, deforestation can cause the erosion of soils, flooding, the pollution of waterways, and have a detrimental impact on biodiversity.</p>
<p>Industry</p>	<p>Since the Industrial Revolution, humans have used fossil fuels to support the manufacturing and transportation of goods. These actions have produced and released unnaturally large levels of carbon dioxide and other greenhouse gases into the atmosphere.</p> <p>These increased levels of greenhouse gases in the atmosphere, mean more heat is trapped by the greenhouse effect, which makes the earth warmer. This is known as global warming.</p>



Causes of climate change

<p>Intense livestock farming</p>	<p>Intense livestock farming provides most of the meat and dairy products consumed around the world.</p> <p>The sector contributes 18 percent of global greenhouse gas emissions.</p> <p>Livestock contribute both directly and indirectly to climate change.</p> <ul style="list-style-type: none"> • Directly through the emissions of greenhouse gases such as carbon dioxide (CO₂) and methane through their digestive waste. • Indirectly, such as CO₂ produced during the operation of farm machinery that use fossil fuels, in the process of fertilizer production, processing and transportation of refrigerated meat products to supermarkets and shops, and release of carbon from cultivated soils to grow feed. <p>Nitrous oxide emissions come mainly from the fertilisers used to produce animal feed and the fermentation of manure.</p> <p>Deforestation and habitat destruction often takes place to provide vast areas of land for grazing and crop production.</p>
<p>Energy use</p>	<p>We use energy including electricity and gas, in our everyday lives to power mobile devices, lights, televisions, fridges, ovens, etc. This energy use makes up a large part of our carbon footprint.</p> <p>Whilst some of our electricity is produced using renewable energies (wind, solar, hydro, biomass, tidal), most of it is still produced by non-renewable energies (gas, coal and oil) and it is the burning of these fossil fuels that release greenhouse gases into the atmosphere.</p>
<p>Travel</p>	<p>How people and goods are transported can have a negative impact on the natural environment and human health. Transport represents nearly 80% of the UK's energy demand.</p> <p>Transport contributes to carbon emissions and can cause air, water and noise pollution. Pollution from transport reacts with other pollutants in the presence of sunlight to form ozone, a gas composed of three atoms of oxygen that forms a protective stratospheric layer that defends us from the sun's harmful ultraviolet rays. At ground level, ozone damages our crops and other plants by entering leaf openings called stomata and oxidizing (burning) plant tissue during respiration. This pollution has direct impacts on human health, causing respiratory and cardiovascular problems when we breath it in.</p>



Consequences of climate change

Invasive non-native species

Climate change is altering the distribution, incidence, resilience to and intensity of animal and plant pests and diseases.

Changes in the climate such as warmer temperatures, changing rainfall patterns, higher sea levels and more frequent extreme weather events, such as flooding, are putting native species under stress as they are unable to adapt to the changes in climate.

Non-native species which are better suited to the higher temperatures and changing climate conditions are increasing in number and moving to new areas as climate change creates more hospitable conditions for them. These invaders often outcompete native species for available resources, introduce new diseases and/or upset the predator/prey balance in an area.

Examples of invasive non-native species in Wales include:

- Tree diseases such as Ash dieback and Phytophthora ramorum that affects larch trees
- Japanese knotweed originally brought over as an ornamental plant
- Grey squirrels, a native of North America deliberately released into the UK in 1876, and carry a pox virus to which our native red squirrel is very susceptible
- Signal crayfish found in our freshwater bodies. It has driven native white-clawed crayfish towards extinction through competition and transmission of a crayfish plague (*Aphanomyces astaci*)

Species extinction

As temperatures warm, many plants and animals have been migrating to higher elevations or toward higher latitudes. Some animals may have difficulty moving to, or adapting to, new habitats.

Climate change also distorts the natural habitats and lives of many plants and animals. For example, the survival of our butterflies, bees and other pollinators are in danger as they struggle to adapt to changing seasons. Globally, warming temperatures confuse plants into flowering earlier each spring, can hinder plant reproduction and limit available food that pollinators rely on.

Relationships between organisms are interlinked, so where one species declines, it may affect other species through a loss of food source or predator-prey relationship imbalance.



Consequences of climate change

<p>Extreme heat and human health</p>	<p>Heat waves caused by global warming present greater risk of heat-related illness and death, including heat exhaustion, heat stroke, cardiovascular disease, and kidney disease.</p> <p>High temperatures also raise the levels of ozone and other pollutants in the air that exacerbate diseases and conditions such as asthma.</p> <p>People at greatest risk of heat-related illness include infants and children up to 4 years old; people 65 years of age and older; people who are overweight or have existing medical conditions, such as diabetes and heart disease; people who are socially isolated; and poorer people as they have less resources to protect themselves from the heat.</p>
<p>More frequent extreme weather events</p>	<p>As the earth warms, the effects around the planet will differ leading to increased rainfall and flooding in some areas, and increased risk of droughts in other areas.</p> <p>Warmer temperatures can cause an increase in human water demand, stressing water supplies.</p> <p>The warming of the atmosphere increases the number of times temperatures reach extreme levels and evaporates more water from the oceans. It is from this hotter, wetter background that extreme weather events emerge creating storms and hurricanes that will occur more frequently, become more intense and last for longer.</p>
<p>Rising sea levels</p>	<p>Global warming causes thermal expansion of land and water. This is the tendency of matter to change in shape, volume, and area in response to a change in temperature. It also causes ice sheets to melt in icy regions of the world and mountain tops.</p> <p>These large volumes of melted ice then flow down into streams, rivers, lakes and seas resulting in rising sea and water levels, causing floods and massive destruction to low-lying towns and cities along water bodies.</p> <p>Research shows that global sea levels rose about 17 centimetres (6.7 inches) in the 20th Century, and the rate in the last decade (2010's) is nearly double that of the last century.</p>



Combatting climate change

Refuse, reduce, reuse, repurpose, recycle

When we refuse, reduce, reuse, repurpose, recycle, items such as cans, bottles, plastic and paper, we send less rubbish to landfill.

This also helps save natural resources such as trees, oil and aluminium.

Manufacturing, processing and transportation of new goods uses energy which releases greenhouse gases.

The more we can follow the 5 Rs, the smaller our carbon footprint will be, especially if we can prioritise ‘reducing’.

When we go shopping, we can make sensible consumer choices such as buying fruit and vegetables without packaging and using our own reusable fruit and vegetable bags, buying locally produced goods (not transported across the world), looking for the recycle mark on products and re-using our shopping bags.

Plant trees

Planting trees is an effective way to lower our carbon footprint.

As trees grow, they absorb carbon dioxide, (one of the greenhouse gases) from the air and lock up the carbon. Whilst a tree is healthy and growing it will continue to hold on to the carbon and absorb more throughout its life.

Planting the right trees in the right places also provides many other benefits for the environment and people such as:

- providing habitat
- providing a source of food for both humans and wildlife
- filtering and cleaning the air
- stabilising soils
- reducing the risk of flooding
- providing shade and shelter
- reducing noise pollution
- providing places to relax, learn and take part in recreational activities

Renewable energy - wind power

Wind power is an important energy source because like other renewable energies, it is naturally replenished.

Wind turbines are often placed in coastal areas, at the tops of rounded hills, on open plains and in mountain gaps, where the wind is strong and consistent. These locations take advantage of the prevailing winds which are caused by huge convection currents. These occur when heat is transferred by the movement of liquids or gases in the earth’s atmosphere, driven by heat energy from the sun.

The moving air (wind) has huge amounts of kinetic energy and this can be transferred into electrical energy using wind turbines. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. The electricity is sent through transmission and distribution lines to a substation, then into homes, businesses and schools.

Fluctuations in wind levels mean turbines cannot always be working and producing power.



Combatting climate change

<p>Renewable energy - solar power</p>	<p>Solar power is energy from the sun and is another important renewable energy source because vast amounts of energy are freely available.</p> <p>Modern technology can harness this energy and produce electricity.</p> <p>However, variations in light levels from cloud cover and night time means a constant supply of energy is not possible.</p>
<p>Renewable energy - marine</p>	<p>Energy from the movement of the sea, its waves, tidal streams and tidal ranges, can be captured to generate electricity.</p> <p>It is predictable and incorporating tidal energy into the grid can provide a reliable source of energy.</p> <p>Marine renewable energies can adapt to climate change. For instance, floating machinery can continue to harvest energy available from higher tides and waves, lessening the challenges of sea level rise and keeping the energy flowing.</p>
<p>Sustainable travel - using public transport, cycle or walk</p>	<p>Using combustion engine vehicles for transport, such as cars, leaves a significant carbon footprint because a car uses petrol or diesel to run which produces carbon dioxide as waste.</p> <p>Buses and trains also produce carbon dioxide. However, as lots of people are using them at the same time, they are more efficient, so the users carbon footprint will be less.</p> <p>Electric cars are a cleaner alternative but still require electricity.</p> <p>Walking or cycling are the most sustainable ways to travel. They have the least impact on the environment, are good for human health and increase physical activity levels.</p>



Combatting climate change

Eat less meat and dairy products

Meeting our needs for food has been identified as one of the big contributors to climate change. Our food system is responsible for many impacts on the environment including soil erosion, habitat destruction and air and water pollution as we grow and transport crops and livestock.

Promoting sustainable agriculture that works with nature, will help to mitigate climate change. For example, sustainable agriculture can improve carbon sequestration, protect our water and air quality and conserve biodiversity.

We need to consider:

- Changing our diets
- Reducing our food waste
- Increasing food production from a smaller area of land

Reducing our consumption of carbon-intensive foods such as meat and dairy products would have a positive impact. Increased plant-based food production could release more land for other purposes such as creating woodlands and meadows which would help to support biodiversity.

Looking for more learning resources, information and data?

Please contact: education@naturalresourceswales.gov.uk or go to <https://naturalresources.wales/learning>

Alternative format; large print or another language, please contact: enquiries@naturalresourceswales.gov.uk
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