What is it and general facts

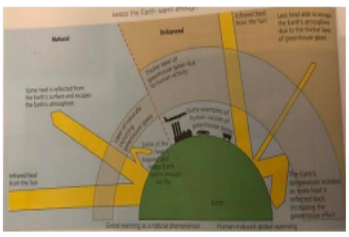
Natural causes of climate change

Volcanic eruptions:

Sunspots (solar output):

Orbital changes:

The Greenhouse Effect – annotate useful facts around image



Challenge of natural hazards - Climate Change Revision Notes

Evidence of climate change

Pollen analysis:

Tree rings:

Ice core samples:

Temperature records:

Human causes of climate change

Fossil fuels:

Farming:

Deforestation:

Cement production:

Impacts of climate change
Annotate around the image (colour code SEE)

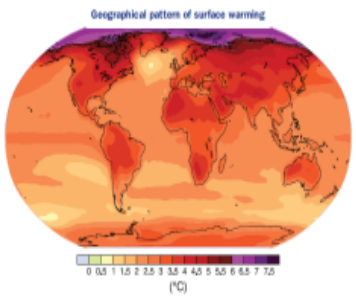


Figure SPM.6. Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. Temperatures are relative to the period 1980-1999. (Figure 3.2)

Managing the Impacts of Climate Change - MITIGATION

Using renewable resources (UK):

Carbon capture and storage (CCS):

Afforestation (planting trees):

International Agreements (Kyoto Protocol):

Managing the Impacts of Climate Change - ADAPTATION

Changing Agricultural Systems (Kenya):

Managing water supply:

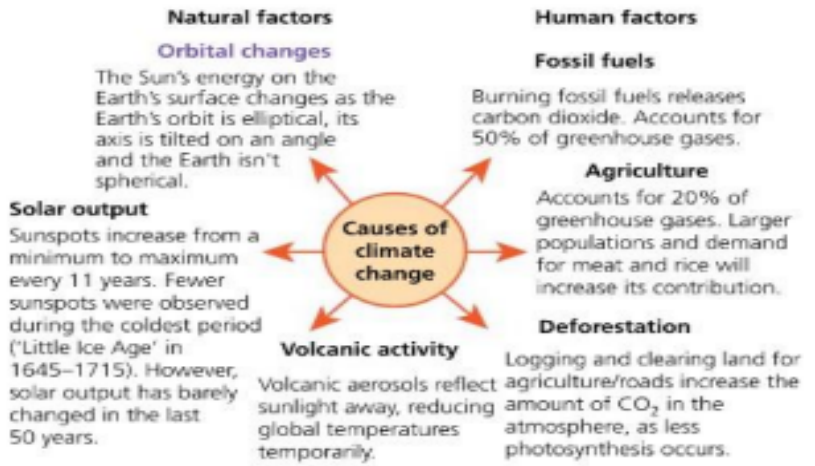
Reducing the risk from rising sea levels (Thames Barrier):

Paper 1: Living with the Physical Environment
Section A: Climate Change

What are the possible Causes of Climate Change?

Climate change is the **long-term** change in weather. Global climate change occurs very slowly over thousands of years.

Evidence of climate change occurring before humans existed means climate change must be natural as well as human enhanced. Natural causes alone cannot account for the significant temperature increase since the 1970s. A thicker layer of greenhouse gases (carbon dioxide 77%, methane 14%, nitrous oxide 8% and CFCs 1%) caused by human activity means less of the Sun's energy is able to escape the Earth's atmosphere, so the temperature increases.



What is the evidence for Climate Change?

Since 1914 the Met Office has reliable climate change data collected using weather stations, satellites, weather balloons, radar and ocean buoys. Evidence includes:

- An increase in the average surface air temperature by 1°C over the past 100 years.
- The warmest ocean temperatures since 1850.
- A 19cm rise in sea levels since 1900.
- Artic sea ice has thinned by 65% since 1975.

Natural records like tree rings, ice cores (spanning 800, 000 years) and ocean sediments (spanning beyond the quaternary period), help estimate climate. The period of timeline that spans from **2.6 million years ago to the present day** is called the **Quaternary Period.** This period marks a time when there was a **global drop in temperature** and the most recent ice age began.

Ice cores are cylinders of ice drilled out of an ice sheet or glacier. The ice encloses small bubbles of air that contain a sample of the atmosphere - making it possible to measure the past concentration of gases in the atmosphere. Antarctic ice cores show us that the concentration of CO_2 was stable until the early 19th century.

How will Climate Change affect People and the Environment?

Effects on People (social effects)	Environmental Effects
• Increase risk of diseases such as skin cancers and heat stroke as temperatures increase. • Winter-related deaths decrease with milder winters. • Crop yields affected - maize will decrease by 12% in South America, yet will increase in northern Europe and require more irrigation. • Less ice in the Arctic Ocean increases shipping and extraction of gas and oil reserves (because we can reach it). • Droughts reduce food and water supplies in sub-Saharan Africa. • Water scarcity in the south and south east of the UK. • Flood risk increase repair and insurance costs. • 70% of Asia at increased risk of flooding. • Declining fishing industry in the Lower Mekong delta will affect 40 million. • Skiing industry may decline in the Alps due to less snow.	• Increased drought in areas such as the Mediterranean region. • Lower rainfall causes food shortages for orang-utans in Borneo and Indonesia. • Sea level rise increases flooding and coastal erosion. • Ice melts so wildlife declines such as Adelie penguins on the Arctic peninsula and polar bears in the Arctic. • Warmer rivers affect marine life, for example the food supply will decrease for the Ganges river dolphin. • Increase in forest growth in northern Europe. • Forests in North America may experience more pests, disease and forest fires. • Coral bleaching - the decline in biodiversity such as at the Great Barrier Reef.

How can we adapt to Climate Change?

Patterns of rainfall and temperature will change. Extreme weather events such as heatwaves, droughts and floods will become more common and the distribution of pests and diseases will change. Some methods of adapting to these impacts include:

- moving production to another location due to changing temperatures and extreme weather,
- increasing irrigation in areas due to changing precipitation and
- Changing the crops grown and the times of year they are planted.

Potato Park in Peru have started to grow crops at higher latitudes.

As sea levels rise, rates of coastal erosion will increase. Fresh water supplies will become contaminated by saltwater and coastal areas will be prone to damage from storm surges. Some methods of adapting to these impacts include:

- Sea defences such as sea walls.
- Building houses that are raised off the ground using stilts.
- Construction of artificial islands up to 3m high so that people most at risk could be relocated.

Millions of people in Asia depend on rivers fed by snow and glacial melt for their domestic and agricultural water supply. In the Himalayas most of the 16 000 glaciers are receding rapidly due to global warming. This threatens the long-term security of water supply in the region. Artificial glaciers are being constructed to supply water to villages in Ladakh, India. Water is collected in winter through a system of diversion canals and embankments and it freezes. When the 'glacier' melts in spring it will provide water for the local villages.

How can we Manage Climate Change?

The burning of fossil fuels to produce electricity, fuels vehicles and power industry contributes 87% of all human-produced CO_2 emissions. The rest comes from land uses changes such as deforestation (9%) and industrial processes such as making cement (4%).

Alternative Energy Provision: To help reduce carbon emissions many countries are turning to alternative sources of energy such as: hydro-electricity, nuclear power, solar, wind and tidal. These do not emit large amounts of CO_2. Some are also renewable and will last into the future. Nuclear power uses uranium to generate electricity but it does not emit CO_2 as a by-product. At current, in 2016, renewables produce more than 20% of the UK's electricity.

Carbon Capture and Storage: Coal is the most polluting of all fossil fuels. China gets 80% of its electricity from burning coal, India 70% and the USA 50%. Carbon capture and storage (CCS) uses technology to capture CO_2 produced from the use of fossil fuels in electricity generation and industrial processes. It is possible to capture up to 90% of the CO_2 that would otherwise enter the atmosphere. Once CO_2 is captured, the carbon gas is compressed and transported by pipeline to an injection well. It is injected as a liquid into the ground to be stored in suitable geological reservoirs such as sedimentary rock as this prevents it from escaping. The UK is the world leader in CCS.

Planting Trees: Trees act as carbon sinks, removing CO_2 from the atmosphere by the process of photosynthesis. They also release moisture into the atmosphere. This has a cooling effect by producing more cloud, reducing incoming solar radiation. Tree planting is well established in many parts of the world. Plantation forests can absorb CO_2 at a faster rate than natural forests and can do so effectively for up to 50 years. The UK has a £24.9 million project to reduce deforestation and increase reforestation in Brazil. It aims to tackle climate change by reducing 10.71 million tons of CO_2 emissions over 20 years by recovering 41,560 hectares of degraded forests.

International Agreement: Paris Agreement 2015 -

- 195 adopted the first ever universal and legally binding global climate deal.
- To peak greenhouse gas emissions as soon as possible and achieve a balance between sources and sinks of greenhouse gases in the second half of this century (2050-2100).
- To keep global temperature increase below 2°C and limited to 1.5°C above pre-industrial levels.
- To review progress every 5 years.
- $100 billion a year to support climate change initiatives in developing countries by 2020, with further finance in the future.
- There have been criticisms that many of these agreements are 'promises' or aims and not firm commitments.