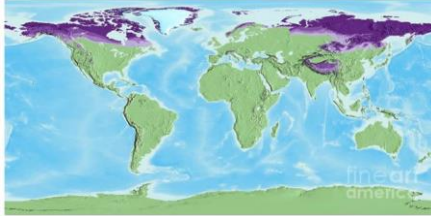


Is climate change the greatest environmental issue?

1. Environmental issues affecting Asia



**Permafrost** refers to areas of permanently frozen ground. They are typically found in areas of high latitude such as the North and South poles, and regions with high mountains.



**Permafrost** is a measuring tool for how the earth is warming.

Yedoma permafrost is one of the most sensitive to change and is found in **Siberia** (Northern Russia).

Siberia has seen big changes in its permafrost. It was formed in the last Ice Age (2 million years ago). Permafrost contains an enormous amount of organic carbon. When permafrost defrosts it exposes ancient layers of dead plants and animals. Microbes from the defrosted permafrost add carbon dioxide and methane which enhance global warming.



**BANGLADESH:** 2/3 of the country is a **floodplain only 2 metres above sea level** (so it is vulnerable to flooding) Bangladesh has one of the largest river networks in the world with a total number of about 700 rivers. Floods are an annual event already due to **monsoons, snowmelt and the number of rivers**. **Climate change** will melt ice in **Himalayas** increasing the flow in the rivers. This causes more river-bank erosion. The country could receive 14% more rainfall by 2028 meaning more land will be flooded. **Less land will be available leading to overcrowding** on the land left. Climate change could increase the occurrence of tropical storms Increased sea level will mean more salt in the soil (**salt water intrusion**) not allowing crops to grow. 1°C rise in temp would flood 11% of the country and affect 55million people. A 1 metre sea level rise will permanently drown a third of the country.



100 000 people every year are being forced from their land. Their homes and farmland land are being eroded away and flooded by the full rivers and rising sea levels. These **climate refugees** have no choice but to move.

## 2.Climate change

### What evidence is there for climate change?

**Ice cores:** Ice sheets are made up of layers of ice (Greenland / Antarctica - one layer is formed every snowfall and compressed by later falls.

Scientists can analyse the gases (such as carbon dioxide) trapped when the ice formed to tell what the temperature was each year. They drill down in to the ice to obtain cores of ice that go back 100 000s of years.

**Climate change** is the changes to world climate that can mean an increase or a decrease in temperature.

**Paleoclimatology:** The science of reconstructing climate history.

**"Proxy" data:** The collecting of indirect evidence of climate change.

**Dendrochronology:** (the study of tree rings): Scientists can take cores and count the rings to find the age of a tree. The thickness of each ring indicates growth. Thick rings = warm and wetter conditions. Narrow rings = cooler and drier conditions. Tree rings can reliably show and date climate change up to 10,000 years ago.



**Pollen analysis:** Pollen from plants is often preserved in sediment (taken as cores from peat bogs and lake beds. The type of plant the pollen is from can tell us about past climates.



Photograph 4.1 A boat bar on the Thames in 1677

Paintings, harvest records and even poems (such as Lord Byron's 'Darkness' can all tell us of past climates and how they have changed. The problem is that they only provide an overview and they aren't precise. More recent technology is more accurate such as satellite imagery and thermometers.

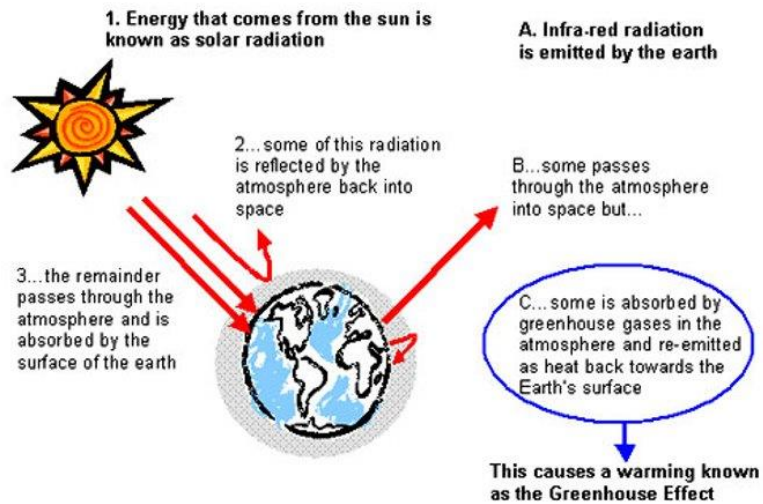
### Natural causes of climate change:

**Orbital Changes:** The way the Earth moves around the Sun changes, e.g. the path of the Earth's orbit around the Sun changes from an almost perfect circle to an ellipse and back again every 96,000 years. These changes affect the amount of solar radiation (how much energy) the Earth receives. If the Earth receives more energy, it gets warmer. Orbital changes may have caused the glacial and interglacial cycles of the Quaternary Period.

**Volcanic Activity:** Major volcanic eruptions eject large quantities of material into the atmosphere. Some of these particles reflect the Sun's rays back out to space, so the Earth's surface cools. Volcanoes also release CO<sub>2</sub> but not enough to cause warming. Volcanic activity may cause short-term changes in climate, e.g. the cooling that followed the eruption of Mount Pinatubo in 1991./ Tambora - Year without a summer .

**Solar output:** The Sun's output of energy isn't constant - it changes in short cycles of about 11 years, and possibly also in longer cycles of several hundred years. Periods where solar output is reduced may cause the Earth's climate to become cooler in some areas.





### The greenhouse effect:

The greenhouse effect is a natural process that occurs when greenhouse gases in the atmosphere trap heat from the Sun, warming the Earth's surface. This process is necessary for life on Earth, but an increase in greenhouse gas concentrations can lead to global warming and climate change.

### How are humans enhancing the greenhouse effect and causing climate change?



**BURNING OF FOSSIL FUELS:**  $CO_2$  is released into the atmosphere when fossil fuels (coal, oil, natural gas and petrol) are burnt. This happens in vehicles, industry and power stations etc.



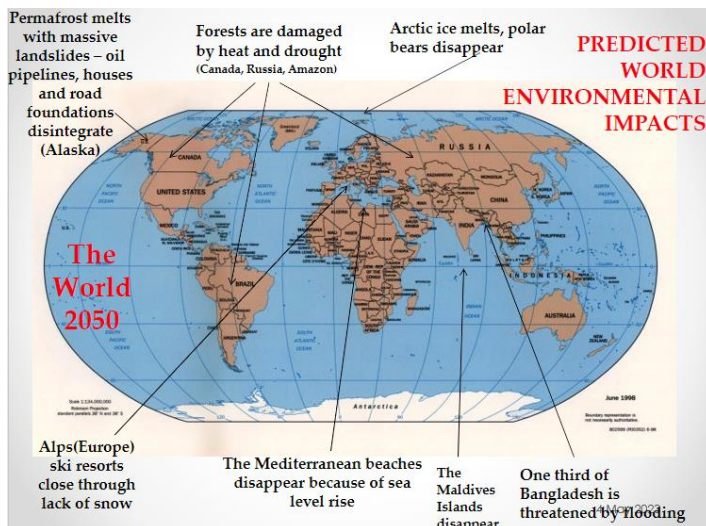
**CEMENT PRODUCTION:** Cement is made from limestone which contains carbon. When cement is produced, lots of  $CO_2$  is released into the atmosphere.

**FARMING:** Farming of livestock produces methane - cows love to fart!

Rice paddies contribute to global warming because flooded fields emit methane.



**DEFORESTATION:** Plants remove  $CO_2$  from the atmosphere and convert it into organic matter using photosynthesis. When trees and plants are chopped down, they stop taking in  $CO_2$ .  $CO_2$  is also released into the atmosphere when trees are burnt as fuel or to make way for agriculture.



The **tipping point** is reached when climate change occurs irreversibly and at an increasing rate. Pre-industrial (recent history) levels are said to have been at around 280 parts per million. Current levels (2009) are 384.78ppm and the tipping point is 450ppm carbon dioxide. **Breaching this threshold is believed to bring catastrophic changes.**

### 3. Economic development in cold environments



**Prudhoe Bay Oil** is the largest oil field in North America and commercial drilling started in the 1960s. It is in the far north of **Alaska**, where temperatures are on average  $-9^{\circ}\text{C}$  but have reached as low as  $-48^{\circ}\text{C}$ .

The **Trans-Alaskan pipeline** is 800m long. It stretches from Prudhoe Bay to the Gulf Of Alaska (Valdez). It cost \$8 billion and was built in 1969. It is one of the largest pipelines in the world.

**How do they move the safely?** How technology has helped in its construction:

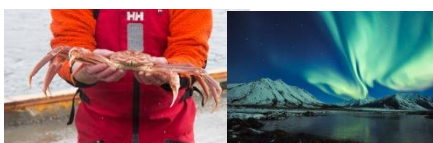
- \*The pipes are raised above ground to stop the permafrost from melting. This also allows caribou to migrate underneath it (raised)
- \*Pipe insulation (to stop them from freezing) Pipes are warmed to keep the oil moving.
- \*Zig-zig pattern of construction, to keep the oil flowing.
- \*Leak detection sensors.
- \*'Sliding shoes' so it moves in case of an earthquake.



**The Exxon Valdez oil spill** happened in 1989. It was the worst oil spill in U.S. history until the Deepwater Horizon oil spill in 2010. There are concerns about further oil exploration in the Arctic.

**Greenpeace conservation group** had a successful campaign when it managed to stop Lego using Shell as a sponsor.

**The Antarctic Treaty** was set up in 1959 with an aim to protect Antarctica from being damaged by economic development. It was agreed that the continent should remain a place of peace and science and no drilling is permitted until at least 2048.

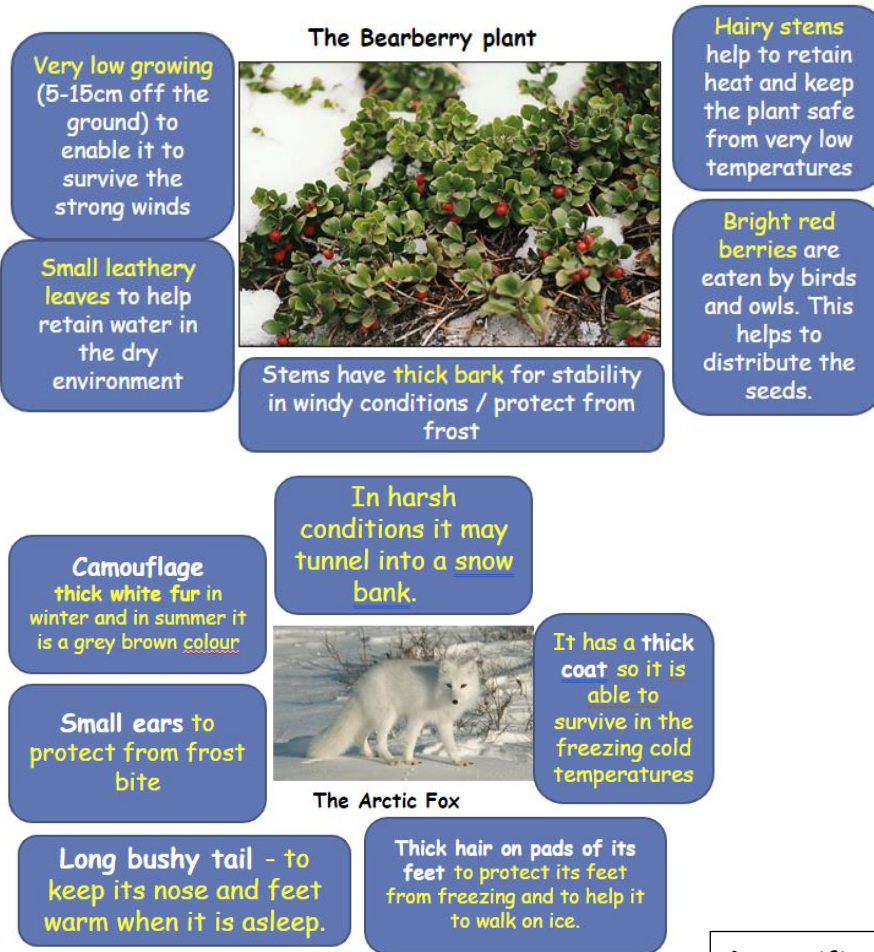


**Svalbard** is the northern most permanently inhabited town and is located in the Arctic circle. People make money in several ways:

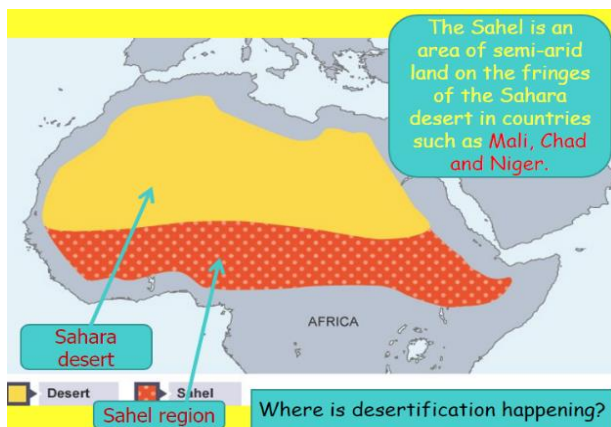
- \***Coal mining**- employs 300 people.
- \***Tourism**- people come for such things as polar bear tours or to see the Northern Lights.
- \* **Fishing**- There are some of the richest fishing grounds in the world with over 150 species of fish.



## How do animals and plants adapt to cold environments?



## 4. Desertification in the Sahel



To reduce the risk of desertification the **Great Green Wall** initiative was created which involved planting trees across the Sahel. This reduces soil erosion and provides shade for crops and animals. **Charities** provided **solar cookers** to people to reduce their need for fuelwood and people constructed low stone walls called **BUNDS** reduce soil erosion and slows down the flow of water.

**Desertification** is the process of land turning into desert as the quality of the soil declines over time. **Causes include:**

**Felling trees for fuelwood.** This leaves land open to soil erosion by the wind and rain.

**Overcultivation** means that the soil becomes **exhausted** easily as all nutrients are used up. This leads to the deterioration of soil quality.

**Overgrazing** by cattle leaves soil exposed to erosion.

**Overpopulation** means that more people are forced onto the marginal land at the edge of the desert. This soil is exhausted easily.

**Climate change** is resulting in unreliable rainfall, resulting in crop failure.

## 5. South America



The **Atacama desert** is located in the west of South America. With an average of only 1mm of rain per year it is known as **the driest place on earth**. Even so, it is home to 1 million people. The Atacama is tucked in the shadow of the snow-capped **Andes Mountains**, which block rainfall from the west.



The people of the Atacama use **fog harvesters** to catch water. As the wind blows fog through the device, the mesh catches the droplets, and gravity pulls the water down into containers underneath.



The **Amazon rainforest** is found in the north of South America. It is home to native American tribes and has an abundance of plants and animals, this is known as **biodiversity**.

**Deforestation** has resulted in huge areas of the Amazon Rainforest being cleared. **The Brazilian government has actively encouraged this as a means to make money.**



**Shifting Cultivation:** This is farming in the Tropical Rain Forest where the land is cleared and the vegetation burnt (known as 'slash and burn'). Crops are grown for a few years until the soil becomes less fertile and the crops don't grow so well. At this point a new piece of land is found and the process starts over again.

### What economic opportunities are there in the rainforest?

**Cattle ranching-** Vast areas are cleared to make way for huge commercial cattle ranches. These produce beef for large multinational companies such as McDonalds.

**Commercial Farming-** Forest is cleared for mono-crops such as Soya and Palm oil.

**Logging-** Vast areas of trees are felled for the wood. These are **HARDWOODS** such as mahogany, they can be used to make furniture etc.

**Mining-** for minerals such as iron ore from the world's largest iron ore mine at **CARAJAS** in Brazil. Other minerals mined in the rainforest also include; gold, copper and tin.

**Road building-** The Trans-Amazonian Highway is the longest road at 3300 miles long, It crosses Brazil from east to west. It helps to transport timber and cattle across Brazil.

**Dam building-** Brazil has a need for cheap electricity to help its industry. One way to get it is to build huge dams on the rivers of the Amazon rainforest. The reservoirs created by the dams have destroyed huge areas of rainforest. Many indigenous (native) people have been moved off their land to make way for the dams.

**Whilst there is great financial gain in all this, consider the impacts; loss of biodiversity, flooding and soil erosion, and of course increased amounts of CO2 in the atmosphere which contributes to climate change.**