

## **Chapter 4 An Invisible Blanket**

### **Teacher notes and background information**

- **Aims**
- **Background information**
- **Curriculum links**
- **Web links**

The aim of this chapter is to introduce children to the science behind climate change and what it is that links carbon dioxide being released into the atmosphere and a world that is warming up. In this chapter children will learn about the greenhouse effect, what it is and the impacts it will have on the world and it's climate.

#### **Learning Intentions**

- To recognise that the amount of carbon dioxide and other gases is increasing in the atmosphere and that this is causing the earth to warm up and this is changing the earths' climate.
- To learn about the issues and impacts associated with a world that is getting warmer.

#### **Background information**

##### **The science behind the Greenhouse effect**

The greenhouse effect is the rise in temperature that the Earth experiences because certain gases in the atmosphere (water vapour, carbon dioxide, nitrous oxide, and methane, for example) trap energy from the sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 60°F colder. Because of how they warm our world, these gases are referred to as greenhouse gases.

As carbon dioxide levels are rising in the earth's atmosphere due to human activity, the greenhouse effect is seen as one of the causes of global warming and therefore contributes to global climate change.

More scientific information can be found on Wikipedia.

[http://en.wikipedia.org/wiki/Greenhouse\\_effect](http://en.wikipedia.org/wiki/Greenhouse_effect)

##### **Key greenhouse effect issues that will affect the North West region**

Much of the following has been sourced from the Environment Agency website. Please refer to them for any further clarification. <http://www.environment-agency.gov.uk>

The carbon dioxide already released has determined climatic changes for the next thirty to forty years, but beyond that the changes will depend on the level of reduction from now on. During the 21<sup>st</sup> century carbon dioxide levels are likely to double, resulting in a worldwide temperature increase of 1 degree Celsius. However, taking into account likely positive feedback loops the increase is predicted to be between 1.4 and 5.8 degrees Celsius. The Tyndall Centre suggest that if present emission levels of carbon dioxide and other greenhouse gases continue, the warming could be as much as 10 degrees Celsius. Some of the predicted implications of this for the North West are outlined below.

## **Changing climate and weather patterns – general points:**

6 of the 10 warmest years on United Kingdom records were between 1995 and 2004. Predictions for 2080 for the North West are as follows:

- Winter rainfall up 30 per cent
- Summer rainfall down 50 per cent
- Snowfall down 90 per cent
- Temperature up between 1 and 5 degrees Celsius
- Increasing numbers of storms and rain increasingly likely to fall in intense downpours (all year)

## **Sea level changes and coastal flooding:**

Sea levels around the UK are now 10cm higher than in 1900, and the average number of winter storms has increased significantly. The sea level at Liverpool has risen 6 centimetres in the last fifty years. By 2080, sea levels around the North West may rise by 67 centimetres, and the risk of tidal surges during storms will be much greater. Consequently, large areas of the North West coast are likely to experience flooding, or in some cases be lost completely.

Significant areas of the North West's industry (including petrochemicals, an oil refinery and a nuclear power plant) are vulnerable, being located on flat, low-lying land only just above existing high tide sea level. (The Bromborough sewage treatment works on Merseyside was flooded in 2001.) Many settlements may have to be abandoned, or protected with expensive flood defences. (see Chapter 6)

The North West coastline is important for migratory birds, and for many well-known British species such as red squirrels and the arctic char. Some key nature reserves, such as the Royal Society for the Protection of Birds reserve at Gayton Sands in Cheshire, or the World Wildlife Trust reserve at Martin Mere in Lancashire may be lost completely, with consequences for the regions biodiversity.

## **Inland flooding:**

Wetter winters and more heavy downpours will significantly increase the flood risk inland. Lag times will be reduced due to soils being saturated for more of the winter season, and baked hard in the summer months (increasing the likelihood of localised but severe summer floods when it does rain). Peak river flows are estimated to be twenty per cent higher by 2080. Across England and Wales an estimated £22 to £75 billion pounds will be needed to engineer sufficient flood defences this century, and protect the millions of people who will be living in flood risk areas. Currently 212,500 properties in the North West are at risk of flooding, and over £40 million is spent per year protecting people and property in this region.

In January 2005, Cumbria experienced severe flooding when the River Eden and its tributaries overtopped 8 kilometers of flood defences. Thousands of people were evacuated and over 2,000 properties flooded in Carlisle alone, with Cockermouth, Keswick, Appleby and Kendal also affected. Communications were severely disrupted across the region. This scenario could become far more common place in future years.

## **Increased air and water pollution:**

High temperatures and low river flows (in summer months) provide ideal conditions for the accumulation and concentration of pollutants. Eutrophication is likely to increase, with consequences for fluvial habitats and biodiversity.

Flooding may result in sewage systems being overwhelmed more often, with resultant pollution problems in urban areas.

Higher summer temperatures are predicted to lead to higher levels of ill health and even death. With the hottest days reaching 40 degrees Celsius and above, more deaths are expected from heat stroke among vulnerable populations. Poorer air quality (linked to higher temperatures) is predicted to result in an increase in asthma and other conditions related to breathing difficulties.

### **Changes within agriculture:**

Agriculture within the region may have to change significantly to adapt to a longer growing season with reduced soil moisture. An increase in stormy weather is likely to threaten crop growth and harvesting more often. Pests may survive the warmer winter months in greater numbers, having a negative impact on crop growth and animal welfare and therefore on income. Soil erosion will become a bigger issue, due to the changing volumes and increased intensity of rainfall throughout the year.

### **Impact on biodiversity:**

Climate change is expected to push the natural climatic range of wildlife species north by about fifty to eighty kilometres a decade. This means that northern species will be squeezed into ever smaller areas of the landscape, and habitats such as upland heaths and meadows will retreat up mountainsides. Species such as the snow bunting, and arctic alpine plants such as the purple saxifrage could disappear from the region entirely. Britain could also lose its place as an important wintering ground for wader birds which will migrate further north instead.

Tidal wetlands such as salt marshes are threatened by sea level rise, salinity changes and storm erosion. Inland flooding can also decimate populations of ground nesting birds if it occurs during nesting time. For example it is estimated that the summer floods of 2007 have contributed to a 45 per cent fall in the number of blue tits across the United Kingdom this year.

### **Curriculum links**

KS 2 Science  
Unit 4C: Keeping warm  
Unit 5C: Gases around us

### **Web links**

[http://news.bbc.co.uk/1/hi/english/static/in\\_depth/sci\\_tech/2000/climate\\_change/greenhouse/default.stm](http://news.bbc.co.uk/1/hi/english/static/in_depth/sci_tech/2000/climate_change/greenhouse/default.stm) Green house effect simulation and information

[http://www.sustainableenergy.qld.edu.au/activity/activity1\\_1.html](http://www.sustainableenergy.qld.edu.au/activity/activity1_1.html) Australian website with lots of great activities and fact sheets linked to sustainable energy and climate change.

[http://en.wikipedia.org/wiki/Greenhouse\\_effect](http://en.wikipedia.org/wiki/Greenhouse_effect) Scientific explanation of the greenhouse effect

<http://www.environment-agency.gov.uk> Environment agency website

[http://www.npower.com/web/At\\_home/index.htm](http://www.npower.com/web/At_home/index.htm) for electricity game and 'climate cops'

[http://www.foe.co.uk/campaigns/climate/issues/climate\\_change/index.html](http://www.foe.co.uk/campaigns/climate/issues/climate_change/index.html) Friends of the Earth website with lots of information about climate change and downloadable resources

## Chapter 4 An invisible blanket

### Activity guidance

In the following activities, children will be researching into how the greenhouse effect occurs, by searching for information on websites and through the use of experiments on insulation.

### Starter Activity - Simulation of greenhouse effect

Visit the link below. Show children the BBC simulation of what is happening to cause the green house effect.

[http://news.bbc.co.uk/1/hi/english/static/in\\_depth/sci\\_tech/2000/climate\\_change/greenhouse/default.stm](http://news.bbc.co.uk/1/hi/english/static/in_depth/sci_tech/2000/climate_change/greenhouse/default.stm)  
also lots more of interest on this site.

### Activity 1 Insulating children!

This activity is to develop children's understanding of insulation, the activity can take place in a heated classroom or during a PE lesson. Divide the class into pair get the children to put on outdoor winter clothing including hats and gloves. Sit quietly to see how this feels, then exercise vigorously for 5 minutes, sit quietly again and see how it feels when more heat has been generated which cannot escape.

Children can record on white boards how they felt at the beginning of the activity and how their body felt after exercise in their outdoor clothing.

### Activity 2 How Does the Greenhouse Effect Work?

This activity explores the science behind the insulating effect of the layer of carbon dioxide and other gases that is building up in the atmosphere. It compares what happens to the temperature of the air in a sealed plastic bottle and the air an open plastic bottle when a heat source is applied to both. The activity is only suitable for teacher demonstration.

### Resource list

- Sand tray
- 2 plastic bottles with the tops cut off
- 2 thermometers
- Lamp / Angle poise lamp with strong bulb (150 watt)
- Cling film
- Masking tape
- Worksheet from website below
- Pencils

The activity has been sourced from the website below:

[http://www.sustainableenergy.qld.edu.au/activity/activity1\\_1.html](http://www.sustainableenergy.qld.edu.au/activity/activity1_1.html)  
also have a look at Fact Sheet 1 on this site and Activity 3.3

### Plenary Activity

Ask children to talk in pairs for 1 minute about the greenhouse effect and to note down 3 main facts they can remember on a white board. After a minute get groups to share their facts. Discuss any remaining misconceptions.