

Chapter 5 On Our Doorstep

Teacher notes and background information

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- **Background information**
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Learning Intentions

- To understand what the local and regional impacts of climate change will be
- To provide pupils with a chance to consider their personal responses and reactions to these changes, as well as developing their knowledge and understanding about the local area and region in which they live
- To understand what the challenges of climate change may be in their local area and that carrying on as we are and doing nothing to mitigate our impact on the planet could lead to uncontrolled change.

Background Information

Introduction to the North West Region

The North West region covers around 14,000 square kilometers and is home to about 7 million people, most of who live in the urban areas of Merseyside and Greater Manchester. It encompasses the five counties of Cheshire, Merseyside, Greater Manchester, Lancashire and Cumbria. The variety of landscapes includes the mountains and lakes of the Lake District, the seaside at Blackpool and the industrial heritage of Manchester. Agriculture covers 80 per cent of the region, with grassland (permanent pasture) the dominant land use. There are over four hundred Sites of Special Scientific Interest, with 29 per cent of the landscape designated as nationally important, including many valuable habitats and wildlife areas. The region is also home to large industrial sites, such as Ellesmere Port on the Mersey estuary.

This chapter explores the predicted consequences of climate change in the North West, and touches upon the anticipated reduction in fossil fuel supplies. These two issues are discussed together because.....

1. They are intimately connected. Burning fossil fuels has contributed to the rising global emissions of carbon dioxide, and thus to climate change. Clearly this accounts for only some of the greenhouse gas emissions. The other significant element of the connection is that use of oil has facilitated the current western consumer lifestyle, which itself has been a tremendous cause of greenhouse gas emissions.
2. They are both imminent challenges to be faced. Our current way of life is dependent on the use of oil and other fossil fuels and on it being acceptable to produce greenhouse gas emissions as waste products. The loss of cheap, accessible oil and the consequences of climate change are the dual triggers which require us to change our current way of thinking.

3. The way forward can address both these issues simultaneously. Many of the solutions to these challenges can and are cutting the use of oil in all forms, whilst being carbon neutral. Chapter 7 encourages forward thinking along these lines and beyond, so it seems appropriate to consider the implications of both issues together here.

The leaf sorting activity has been deliberately limited to negative consequences, to highlight the real problems that we are hoping to avoid or mitigate. These could be viewed as the triggers for change in the North West region. It is not intended to imply that wider national and global consequences are not deeply important and of enormous educational significance, it is merely the focus point of this resource.

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 30-40 years, but beyond that the changes will depend on the level of reduction from now on. During the 21st 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 UK records were between 1995 and 2004.

Predictions for 2080 for the North West:

- 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 United Kingdom are now 10 centimetres 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 50 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 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.

The North West 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 Wildfowl and Wetlands Trust reserve at Martin Mere in Lancashire may be lost completely, with consequences for the region's 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 20 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 kilometers 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 percent fall in the number of blue tits across the United Kingdom this year.

Changes in the climate will change the balance of opportunities, but we are not in control!

Additional opportunities highlighted by the Environment Agency in their report: 'The Climate is Changing, Time to get Ready' www.environment-agency.gov.uk include:
The changes may be positive and negative, the issue is responding to uncontrolled change could be a roller coaster. We have highlighted some positives you may wish to consider some of the downsides to change.

Health

- significantly fewer cold-related deaths (mainly the elderly)

Farming

- Higher levels of carbon dioxide may allow plants to grow faster – again if there's enough water.

Business and Industry

- expansion of wave and wind power potential

Tourism and Leisure

- warmer, drier and sunnier summers could benefit domestic summer tourism

Biodiversity

- Warmer temperatures will allow some plants and animals to expand their range – but for others it will contract.

Curriculum links:

Geography:

Geographical enquiry and skills (2a,c,d,f)

Knowledge and understanding of places (3b,c,d,e)

Knowledge and understanding of patterns and processes (4a,b)

English: Group discussion and interaction

Useful websites:

The UK Climate Impacts Programme (UKCIP) -

http://www.ukcip.org.uk/climate_change/what_is_climate_change.asp - provides scenarios that show how our climate might change and co-ordinates research on dealing with our future climate.

Climate charts - <http://www.climate-charts.com/> - the largest accessible collection of climate data on the web

New Scientist Environment - <http://environment.newscientist.com/specials.ns> - news and search the latest global warming articles.

<http://www.ipcc.ch/press/index.htm> latest report on global climate change delivered November 2007, good for up to date facts and figures.

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Activity Guidance

Learning Intentions

- To understand what the local and regional impacts of climate change will be
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- To understand what the challenges of climate change may be in their local area and that carrying on as we are and doing nothing to mitigate our impact on the planet could lead to uncontrolled change.

Key climate change issues that may face the North West region include:

Sea level change

Temperature change

Increase in extreme weather events

Species extinction, changes in biodiversity

Changes in farming and food production/crop and pest diseases

Rises in transport, fuel costs and knock-on effects to personal travel and especially rural communities

Possible immigration from other regions within the UK/Europe and beyond

For further information, see issue 'leaves'.

Activity overview

In this activity, children are using a range of information sources (maps, non fiction sources, web based interactive databases) to identify the impacts that climate change will have on their local area. They will prioritise the perceived importance of these impacts through group and class discussion.

Starter Activity

Using a map of the local area, for example an Ordnance survey map, multimap <http://www.multimap.com> or other mapping software, identify your **local area** within the **North West** region.

Identify a well known tree in your area. This may be in your school grounds, local park or an old tree of national significance in your area (to find such a tree, visit the Woodland Trust site: www.ancient-tree-hunt.org.uk). Your tree can act as the 'eyes and ears' of your area, giving both an historical perspective and helping the children to imagine what your area will be like in the future.

Main Activity

Leaf templates provided. These can be copied double sided, with the text on one side, and matching image on the other.

Read the climate change cards provided. Children discuss which of these issues they think will affect their families and home area. Encourage the children to prioritise the cards into three piles:

- a. Those which they perceive will have the **greatest effect** on their lives and home area
- b. Those which they perceive will have **some effect** on their lives and home area
- c. Those which they perceive will have **little or no effect** on their lives and home area

Discuss these choices within a larger group, class setting, encouraging the children to justify their viewpoint.

Look at the sea level change maps and flood zone maps appropriate to your area on an interactive whiteboard to enhance the discussion and focus on issues in your area. You will need to enter the postcode of the school, or other chosen building.

Sea level changes:

http://www.environment-agency.gov.uk/yourenv/eff/1190084/natural_forces/sealevels/

Flooding:

http://www.environment-agency.gov.uk/subjects/flood/?lang=_e

Maps:

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

Following these discussions, re-sort the leaves. Have any moved into a different pile?

Then:

- shade red the leaves in pile (a);
- orange those in (b);
- and green those in pile (c), if any!

Changes in the climate will change the balance of opportunities, but we are not in control!

The changes may be positive and negative, the issue is responding to uncontrolled change could be a roller coaster. We have highlighted some positives. You may wish to consider some of the downsides to change. Children write into the 'opportunities' template leaves provided and shade them in blue.

Children are also encouraged to consider the effect of climate change on their lifestyles and culture.

Plenary and Display opportunity:

On an outline of your chosen local tree, add the coloured leaves. Discuss the proportions of the different colours, and draw out the main effects of climate change on your area.

Depending on the information available about local issues such as sea level rises, flood-risk zones, complete the background of the scene with the appropriate future issues for your locality.

Extension work or homework: Be a climate change expert!

Design a poster to inform local business of the conclusions from your study and what changes they may have to cope with.

You may wish to make links with chapter 6 and 7 where the pupils can highlight some of the solutions through actions that mitigate the impact of climate change

Curriculum links:

Geography:

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Knowledge and understanding of patterns and processes (4a,b)

English: Group discussion and interaction

Acknowledgements

Images sourced from www.flickr.com

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Car in flood	by wallyg
Flood	by aver1816
Fallen tree	by wvs
Flood	by thatjames
Bed	by bennylin 0724
Mountains	by spikewerx

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Case Study: Flooding in Carlisle

Source: Environment Agency website (<http://www.environment-agency.gov.uk/regions/northwest>)

Cumbria floods

The Cumbria floods on 7, 8 and 9 January 2005 affected more than 3,000 properties. Two years have now passed and the majority of people have now returned to their homes, flood defence works have been carried out and two major new flood defense schemes are underway in Carlisle.

On Saturday 8 January, heavy rain fell in thirty six hours over Cumbria. The rain affected many of Cumbria's biggest towns including Keswick, Cockermouth, Appleby, Eamont Bridge, the Eden Valley, Kendal and Penrith, but the worst of the weather was experienced in Carlisle, where two severe flood warnings were issued. These were for the Carlisle and Denton Holme areas of the city and the Rivers Eden, Petteril and Caldew.

The sheer volume of rain in such a short space of time caused flood defences to overtop and 1,700 properties in Carlisle were flooded. Flood warnings were sent out to those who were signed up to the flood warning service.

In Carlisle, a flood defence scheme to improve the standard of protection was already in the planning stages. Following further studies and consultation with the public, the River Eden and Petteril Flood Alleviation Scheme has been approved and construction work began in May 2006 and is due to be complete by 2008.

Work will begin on the Caldew and City Centre Flood Alleviation Scheme in 2008 and complete a year ahead of schedule in 2010.

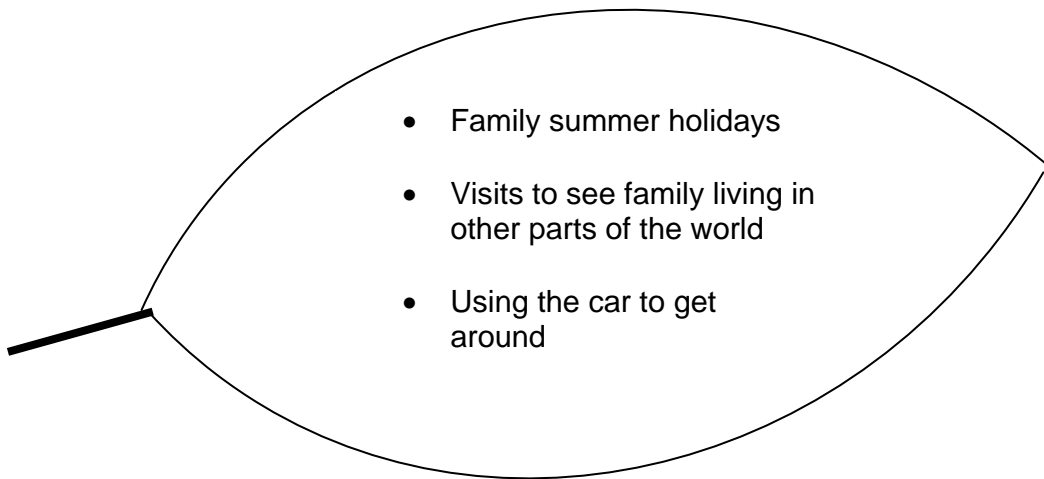
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Climate change will bring challenges to our lifestyles and culture

We will have to think about our lifestyles and may have to change some of the things that we traditionally do as families and communities.

Think about your family and **one** of the **three** things in the leaf below.

1. Will the thing you have chosen be affected by climate change?
2. Explain **how** it will be affected.
3. Explain **what changes** you and your family might have to make.



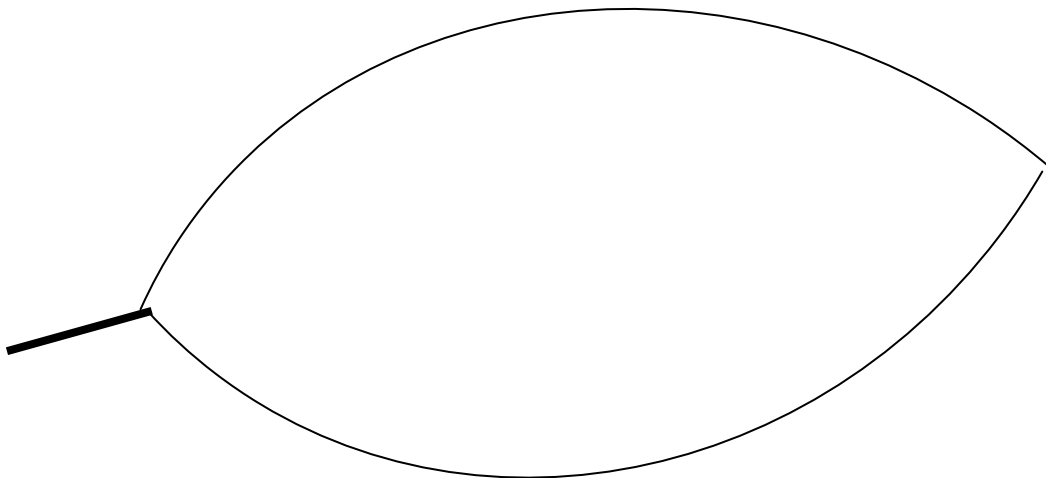
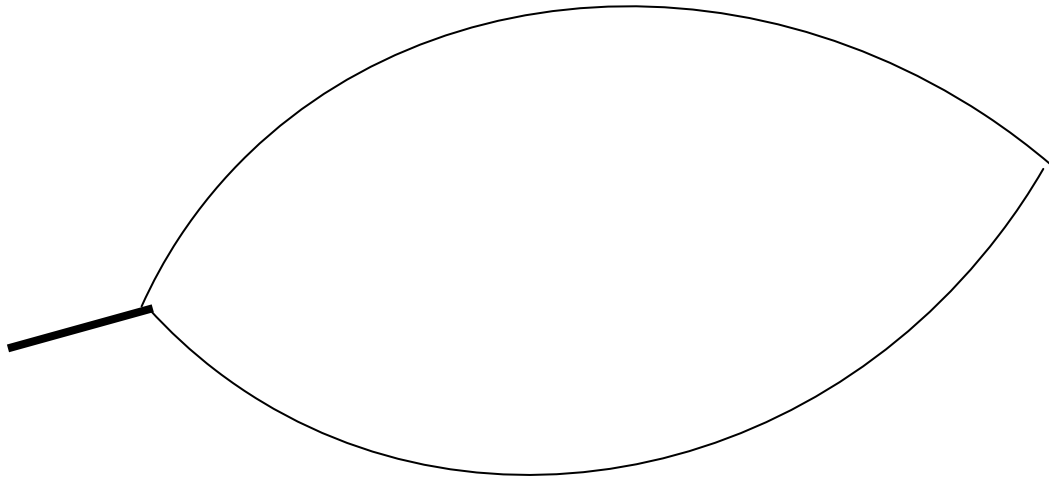
What we usually do...	How might this be affected by climate change?	What changes might you have to make?
.....

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Climate change could bring opportunities!

- Most people will enjoy warmer summers, provided they are not too hot – but there may be more summer storms.
- Farmers could use the longer growing season to expand their range of crops – as long as there's enough water for the plants to grow.
- Less frost damage to crops as really cold winters become a thing of the past. There may also be a longer growing season for crops.

Can you think of any other opportunities that climate change will create for the North West?
Write them into the leaves below.



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Coastal Flooding

- By 2080 sea levels around the North West may rise by 67cm.
- Houses and industry along the coast will have to be moved or protected with very expensive sea defences.
- Greater numbers of storms will make this problem worse.

River Flooding

- Wetter winters and more heavy rainfall will mean hundreds of thousands of homes and other buildings will be at risk as rivers overflow more often.

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Job losses

- If oil prices become very high, companies using oil to make things, will face bigger costs. If costs rise too much, some people may lose their jobs.
- It will also cost a lot more to transport goods.

Cost of living increases

- As oil prices increase, so may the price of everything connected to oil. This includes petrol and shipping fuel, all products which use oil as an ingredient (such as plastics), and oil fired central heating.
- Our energy bills will go up.

Storm damage

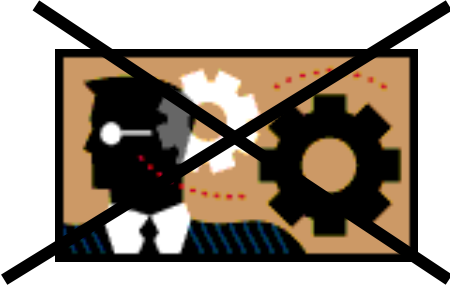
- Storms are expected to happen more often, and be more severe.
- These cause damage to property, electricity supplies, railways, roads and sometimes people are injured or killed.

Threatened coastal habitats

- Rising sea levels and more storm surges will destroy some habitats such as salt marshes, resulting in a loss of wildlife.
- Some of these habitats in the North West are nationally important, and home to rare species of birds and animals.



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Health problems

- Warmer and drier summers may lead to problems with air pollution. This may mean more people have breathing problems such as asthma.
- More people may also die from heat stroke in summer and the spread of viruses in the winter.

Reduced snowfall

- Snowfall may fall by 90 per cent by 2080. Instead we will get more rain and wind throughout the winter months.

Threatened upland habitats

- A rise in temperature will affect all the plants and animals which live in the mountains and uplands of the NW.
- Some of them will not survive because they need the present colder temperatures to live.

Traffic issues

There is predicted to be 40 per cent more traffic by 2059 which will mean more congestion. However, rising costs of petrol may mean that only the richer people will be able to afford to drive cars often.

Problems for agriculture

- Drier summers will mean more money spent on watering crops (irrigation).
- Soil may get washed away by heavy winter rains (soil erosion).
- Warmer winters will mean more pests affecting crops and animals.
- Costs of fuel and fertiliser will rise.
- Food prices will increase

Lifestyle changes

- Extreme weather will affect our lives more often.
- We may have to do without many of the products that we buy today.
- Transport will become very expensive and food supplies will change and costs increase.



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