Everybody has an Impact

Climate Change Impacts in the North West of England

An initiative of the North West Regional Chamber

December 1998
Summary Report
The North West of England

With a population of 7.2 million and a gross domestic product of £60 billion (larger than five European states), the North West of England is demographically and economically one of the most significant regions in the European Union.

Five English counties make up the North West, and contribute to a diverse landscape, from the beautiful open spaces and craggy fells of Cumbria, through the hills of Lancashire and the two major cosmopolitan conurbations of Greater Manchester and Merseyside, to the rolling plains of Cheshire.

The Changing Climate

In the last 50 years the worldwide burning of fossil fuels has resulted in global carbon emissions which have been growing at twice the rate of population. The atmospheric concentration of carbon dioxide, the gas most heavily implicated in the enhanced greenhouse effect, has increased by 30% over pre-industrial levels. Experts now agree that global warming will happen – in fact it is already with us. Fifteen of the world’s hottest years, since records began, have occurred since 1979 and with 1998 set to be another record breaker, the top 5 warmest years in recorded history have all occurred in the 1990s.

But What Will Be the Impacts of Climate Change?

As the Earth’s climate shifts into uncharted territory, this new study unveils the issues and impacts which each and every one of us will have to come to terms with in the years ahead. Business leaders, policy makers and individuals the world over can work to reduce global warming but it is imperative that work begins now to plan a sustainable future for the North West of England.

### Summer Mean Temperature (°C)

<table>
<thead>
<tr>
<th>Average summer 1961-90</th>
<th>Summer 1995</th>
<th>Potential summer 2064</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.5</td>
<td>18.5</td>
<td>17.5</td>
</tr>
<tr>
<td>18.0</td>
<td>20.5</td>
<td>19.0</td>
</tr>
</tbody>
</table>

*By the 2050s, under one climate change scenario, the hot summer of 1995 will become the norm, while an extreme summer in the 2050s will be up to 4.7°C higher than today.*

[University of East Anglia Climatic Research Unit]
The North West of England Climate Change Impacts Study

Introduction

The impacts revealed in this report are as wide-ranging as they are portentous. From the expected implications for flood defences and coastal areas to implications for the construction industry; from new ship designs for stormier seas to 'heat islands' in urban zones, the North West Climate Change Impacts Study demonstrates that when it comes to climate change all sectors of society are affected – everybody has an impact.

The team of researchers working on this study contacted 59 companies and 52 public sector and research organisations. The responses were informed and positive. Some of those interviewed had already considered the implications of climate change and the team’s enquiries met with very little scepticism. There are signs that the North West is preparing to take up the challenge of climate change.

With its innovative regional scenarios of future climatic conditions and comprehensive review of impacts, this report highlights significant areas for action and points the way forward for future areas of research. Some of the impacts outlined may be explored in more depth by those working within the economic sectors that will be affected, while government agencies and other partners must address the tasks within education and policy-making, particularly with regard to the natural environment. At every step the North West Climate Group, the partnership which formed to take forward work on climate change and which initiated this study, must work with the region’s business leaders and policy makers to ensure that the North West is ready for the impacts which have been forecast. With long-range planning and careful analysis of the region’s future climate, the North West can do more than just tackle the challenges ahead; the region can positively develop a real competitive edge in response to climate change.

The strong partnerships which have led to the North West being the first European region to model the impacts of climate change on both the natural environment and the economic and business sectors, the North West has a very real opportunity to position itself ahead of others.

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The Facts of Life

Climate Change is already a fact of life in the North West of England. Sea levels at Liverpool have been rising by 1cm per decade and average temperatures taken at points such as Manchester Airport have been increasing consistently since the 1960s. Levels of winter rainfall have been increasing, and recent flooding and periods of drought only serve to underline the very real need to prepare for an uncertain future as climate change continues.

The greenhouse gas emissions resulting from human activities will add to the natural variability in climate to ensure that the North West’s climate will continue to change dramatically over the next 100 years. A scientific consensus is emerging on the likely pattern of this future climate. It is forecast to include higher average temperatures all year round, more winter rainfall, stable or reduced summer rainfall, higher windspeeds, fewer winter frosts and higher sea levels. It may also bring more variable weather conditions with more frequent storms and higher wave heights.

Overview

The Future Forecast for the North West

- Average temperatures in the 2050s will have increased by between 0.8°C and 2°C.
- Winter rainfall in the 2050s will have increased by between 6% and 14%.
- Summer rainfall may be reduced by up to 10% by the 2050s.
- Sea level will rise by between 12cm and 67cm by the 2050s.

Everybody has an Impact

This study sketches out the potential impacts of climate change upon a myriad of human activities and upon the sometimes fragile natural environments of the region. Climate change will impact on everything from the appearance of the landscape and coastline to the competitiveness of the economic and business sectors. Even the patterns of our individual and community lifestyles will change.
Summary of Regional Climate Change Scenarios

Recent History

Our climate has already changed significantly. Some of the effects felt are a result of natural variability in climate, but humankind’s activities are now adding to that variability significantly. These changes in climate have done much to inform the evaluation of the likely impacts that may lie ahead. In recent years, the North West has experienced the following:

- Annual mean temperatures have risen by 0.4°C at Manchester Airport between 1988 and 1997 when compared to the 1961-1990 average. If this rate of change continues, it would mean a rise of 2.65°C over a century.
- Seasonal rainfall has been seen to vary by as much as 15% from the average in the last 30 years.
- A decrease in summer rainfall of up to 20% experienced over the last century.
- Increases in high intensity winter rainfall have been experienced since the 1960s.
- Sea level rise at Liverpool has increased by around 6cm in the last 50 years.
- An increase in flooding of some major rivers in the region in the last few decades.

The Future Climate

The UK Climate Impacts Programme (UKCIP) has established a range of scenarios for future climate change. These scenarios have been set for the 2020s, 2050s and 2080s and project four alternative levels of climate change with low, medium-low, medium-high and high sensitivity to the effects of greenhouse gas emissions. These scenarios suggest that:

- The rate of future warming in the North West varies from 0.1°C to 0.3°C per decade (1 to 3°C per century).
- Annual rainfall will increase for all UKCIP scenarios, by between 3% and 5%.
- Winter rainfall over North West England will increase by between 6% and 14% by the 2050s, whilst a decrease is forecast for summer rainfall varying from 1% to 10%.
- The record-breaking summer of 1995 will, under the UKCIP medium-high scenario, become the norm in the 2050s, while an extreme summer in the 2050s will be 4.7°C higher than the 1961-1990 average.
- Some winters in the 2050s may be up to 3.5°C warmer than the 1961-1990 average.
- The UKCIP scenarios give a potential sea level rise of between 12cm and 67cm by the 2050s, with the medium-high scenario resulting in rates of sea level rise more than double those observed at Liverpool over the last 100 years.
- Days with minimum temperatures below freezing are likely to be reduced by 65% by the 2050s under the medium-high scenario.
- Days on which the temperature exceeds 25°C will double.

“Washed out: major floods have already been experienced in the North West. [Photo of flooded car park, Didsbury. Manchester courtesy of The Environment Agency]”
## Coastal Areas

The landscape domains most sensitive to change are the uplands and the coastal zone. Much of the North West's coast is low-lying and at risk from flooding, with major flooding experienced in 1983, 1987, 1990 and 1998. Total costs of future sea defences will be considerable, with currently-planned protection scheduled to cost £20 million at Morecombe and £50 million at Blackpool, for example. A trebling of the probability of tidal surges which exceed danger levels is possible in the Irish Sea, as general sea levels rise by up to 15cm during the next 50 years. Increased wind speeds will increase wave height, perhaps by 2mm per year, enhancing the risk of flooding still further.

As the water pushes up against sea defences, the North West will see the loss of mudflats and salt marshes, resulting in serious environmental disruption for internationally significant bird feeding grounds. Fisheries, ports, coastal resorts and farming are all vulnerable, as is the large amount of capital-intensive, coastal-based industry found in the North West. Ports are affected by an increased need for expensive dredging operations as sediment patterns shift due to changes in rainfall and wind direction. The design of ships may have to change also, to maintain maneuverability in the face of higher than average and exceptional wind speeds.

Defending the coast: anti-flooding measures are scheduled to cost £20 million at Morecombe alone. (Photo courtesy of Lancaster and Morecambe Newspapers)

## The Rural Uplands

Inland, the rural uplands will see significant impacts as a result of climate change, particularly with their highly specialised plant and animal communities adapted to a relatively cold climate. Far-reaching changes will occur in many of the domain's niche habitats, even if a relatively modest level of warming occurs. And species loss will be highly likely, including two rare Arctic fish, the Vendace and Shelley from lakes in Cumbria. There will be migration of new species into the region. In fact, new species of butterfly have already arrived due to warmer temperatures including the Speckled Wood, the Comma and the UK's most endangered butterfly, the High Brown Fritillary, which is likely to thrive in warmer conditions. As these new species arrive, land management practices will have to ensure the continued viability of new species.

The upland zones will also be at greater risk of fires which can cost tens of thousands of pounds to extinguish. One recent upland fire in the Peak District cost £70,000 to tackle. Climate change may also result in greater soil erosion as the intensity of rainfall increases. Warmer temperatures, and fewer frosts, will increase the number of natural pests and diseases.

The peat uplands of northern England are a major carbon ‘sink’. Increases in decomposition, driven by the changing climate, could release large amounts of that carbon, accelerating global warming. The peatlands could also accumulate as a result of wetter conditions and more research is needed to determine whether peats act as a source or sink for carbon in the future.
Other Land Management Issues

Though much of the region is dominated by agricultural or urban uses, the region has precious environments including lowland acid bogs, marshes and estuarine ecosystems, many of which are protected by national and international nature conservation designations. Plants and animals subjected to climate change tend to migrate northwards or uphill in search of a more suitable climate. Given the highly developed nature of the region, many of these ecosystems are in isolated ‘pockets’ which offer few ‘natural corridors’ along which species can migrate. Consideration of assisted species migration and new habitat creation may be needed as climate change takes hold.

In urbanised areas, levels of discomfort for those in poorly designed, insulated and ventilated buildings may increase as urban ‘heat islands’ become more common. Street trees may be adversely affected by water deficits and species more suited to the projected climate of the 2050s should be planted where possible from now. Rising water tables may become a problem as the rises attributable to the displacement of industry are enhanced by increased winter rainfall. This greater rainfall may also increase the risks from contaminated land and toxic wastes, as old mine workings and industrial areas flood.

Sacred sites: Sites of cultural or historical value are likely to be affected by Climate Change.

[Photo of Castlerigg Stone Circle courtesy of the National Trust Photographic Library/Mike Williams]

The Cultural Heritage

The ancient burial sites, historic buildings, gardens and parks which make up an important part of the North West’s cultural heritage are, by virtue of their age or location, extremely sensitive to climate change. Alterations in rainfall, sunshine or humidity may have significant effects and the pressures placed on those managing this heritage will be significant. The National Trust, for example, must allow for climate change impacts in relation to coastal management, nature conservation, historic gardens, archaeology, soils, tourism, agriculture, water resources, historic buildings, forestry and energy use. Within buildings, rooms containing sensitive fabrics, paintings or furniture may need new temperature and light controls to allow for warmer conditions and more sunshine. Repair bills for the roofs and fabric of historic buildings may rise as conditions become windier and stormier.

“The ancient burial sites, historic buildings, gardens and parks which make up an important part of the North West’s cultural heritage are, by virtue of their age or location, extremely sensitive to climate change.”
Economic and Business Impacts

The Water Industry

"Workers in buildings which are not designed for a warmer future are already experiencing unpleasant working conditions and work-related stress which will worsen in the years to come."

Changing patterns of rainfall are of particular concern to the water industry in the North West with periods of prolonged drought, resulting in reduced availability of water for customers. The drought of 1995/6 saw reservoirs drained to record low levels. At Haweswater and Thirlmere in the Lake District, levels declined to less than 10% of normal levels, while in the Pennines some reservoirs were emptied. Hosepipe bans and drought orders were introduced, while the costs of additional pumping ran into millions of pounds.

The Insurance Industry

"Storm damage and flooding from both rivers and the sea represent very real insurance risks with one insurance company in the region estimating an exposure of £192 million to coastal flooding."

Increases in storms and in flooding will affect the insurance sector. For some firms, present policies are not based on a warmer, wetter, stormier future but upon the weather patterns experienced over the last few decades. Storm damage and flooding from both rivers and the sea represent very real risks, with one insurance company in the region estimating an exposure of £192 million to coastal flooding.

In manufacturing, the increased temperatures will have implications for both water management and working conditions. The need for additional cooling, greater flood risk and reduced water quality will be significant issues for many sectors including the chemical and food industries while electricity distribution, construction and fisheries will also be affected in the next century.

To stay ahead of the game, adaption and adjustment in the face of a changing climate will be essential for industries in the region. The expenditure needed by individual companies will range from a few hundred pounds to hundreds of thousands of pounds. With the typical lifetime of plant machinery ranging from 10 to 40 years, managers are in a position to adapt to climate change when the replacement of equipment becomes necessary, as long as they recognise that the climate is changing and will continue to change and take account of it in their future plans. Energy efficiency improvements of at least 20 or 30% can also be achieved through these replacements.

Some sectors are only now developing an awareness of the changing climate. Many architects and designers are still creating buildings based upon the cooler climate of the 1960s and 1970s. Workers in buildings which are not designed for a warmer future are already experiencing unpleasantly hot working conditions in summer and work-related stress which will worsen in the years to come.

The Water Industry

[Photo of Haweswater courtesy of North West Water]

Dried out: even after record levels of rainfall, 1995's dry, hot summer still emptied reservoirs in the region.

The Insurance Industry

[Photo of Haweswater courtesy of North West Water]

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New Opportunities

Some of the impacts of climate change could prove beneficial. The changing climate will offer up new opportunities for businesses in the North West, with some economic sectors like tourism, recreation, agriculture, food processing, construction and transport seeing new and expanding market opportunities. Specialised industries could also benefit, for example, those producing renewable energy products like photovoltaics.

Hotter, drier summers could bring changes in lifestyles, with more outdoor activities resulting in positive commercial, social and health impacts. Health impacts in general will be mixed, with reduced winter mortality rates amongst the elderly, better diets and more outdoor activities offset against greater levels of air pollution, heat stress, increased incidence of food poisoning and a potential increase in communicable diseases.

Growing Markets

For the region’s farmers agricultural options will broaden out as new crops and varieties become viable. While some of these crops may bring in better profit levels, particularly in more fertile locations, the region’s soil quality will remain a limiting factor for many farmers. Agriculture will also benefit from a longer and more productive growing season, reducing the need for bought-in feedstuffs and boosting profits. Forestry may also flourish, provided that soil water and minerals are plentiful and that tree varieties are chosen which favour higher temperatures and longer growing seasons.
### Summary of Likely Impacts of Climate Change

**Urban Core & Urban Fringe**
- More outdoor activities (community life, ‘café society’, etc.)
- Healthier lifestyles.
- More active population (with increased opportunities for walking, cycling, etc.)
- Economic benefits for the leisure industry, greater potential for community forests.
- Lower winter heating bills.

**Coast**
- Opportunities for coastal zone regeneration.
- Higher incomes from tourism.
- Expansion of more temperature and moisture dependant species, e.g. blanket bogs, beech trees, reptiles and insects.

**Rural Uplands**
- Migration of new species.
- Enhanced vegetation growth due to higher temperatures and a longer growing season.
- New opportunities for farmers and landowners, e.g. extended stocking of land and higher productivity of grasslands.
- Greater recreational opportunities and associated economic benefits (e.g. outdoor pursuits).

### Summary of Likely Sensitivities and Future Scenarios of Climate Change

The following tables aim to summarise the likely impacts of climate change in the North West according to our best judgement. The tables do not present predictions, but likely sensitivities given the climate change scenarios presented by the UKCIP. We have decided whether the impacts are beneficial or detrimental by asking what will be the effects of climate change upon: a) ecosystems; and b) current and likely future infrastructure and business activities (using the assumption that ‘business as usual’ happens in the next 20-80 years). The decision to define the impacts as beneficial or detrimental is inevitably a judgement, but does reflect a consensus amongst the members (stakeholders and scientists) of the North West Climate Group.

#### Beneficial effects

- More outdoor activities (community life, ‘café society’, etc.)
- Healthier lifestyles.
- More active population (with increased opportunities for walking, cycling, etc.)
- Economic benefits for the leisure industry, greater potential for community forests.
- Lower winter heating bills.

#### Detrimental effects

- Water shortages for garden irrigation.
- Stresses upon parks and gardens in their traditional form.
- Stresses on street trees.
- Heat island effect: unpleasantly hot micro-climatic conditions in homes, workplaces and recreational areas.
- Health risks through sunburn and other atmospheric pollutants (e.g. PM$_{10}$, SO$_2$).
- Structural damage, from storms, to buildings and other infrastructure.
- Additional stress for remnant semi-natural habitats.
- Flood risk from streams, rivers and sewers.
- Increased uptake of air conditioning, increasing energy costs.
- Rise of water tables in industrial areas accelerated.

#### Comments

- Dependent on other socio-economic and environmental factors, e.g. ‘greying’ of the population, greater mobility, higher disposable income and shifts in lifestyles.
- Reduction in disposable income also possible however. This would reduce the potential benefits of climate change resulting from more cultural-based recreation.

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**Urban Core & Urban Fringe**

- Opportunities for coastal zone regeneration.
- Higher incomes from tourism.
- Expansion of more temperature and moisture dependant species, e.g. blanket bogs, beech trees, reptiles and insects.

**Coast**

- Migration of new species.
- Enhanced vegetation growth due to higher temperatures and a longer growing season.
- New opportunities for farmers and landowners, e.g. extended stocking of land and higher productivity of grasslands.
- Greater recreational opportunities and associated economic benefits (e.g. outdoor pursuits).

**Rural Uplands**

- Loss of niche habitats and species.
- Erosion (localised and widespread).
- More grazing on young shoots with detrimental effects upon vegetation.
- Potential for decreased vigour of vegetation due to water deficit.
- Windthrow of forests.
- Potential for shifting patterns of agriculture with ecological impacts.
- Increased fire risks.
- Recreational pressures.
- Impacts of new water supply/transfer options.
- Low water flows/levels reducing water quality with impacts on biodiversity.
- Increased ‘flashiness’ of streams and rivers, increasing flood risk and affecting biodiversity.

High dependence on agricultural policy, i.e. grazing pressures. Limited understanding of the complexities of the interactions between climate, land use and ecosystems. In Cumbrian lakes, however, strong coupling between weather events (position of the Gulf Stream) and lake physics, chemistry and biology has been established.
### by Economic Sector

<table>
<thead>
<tr>
<th>Beneficial effects</th>
<th>Detrimental effects</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Better storage conditions.</td>
<td>• More cooling (new equipment and increased running costs).</td>
<td>Commercial considerations likely to outweigh climate change impacts.</td>
</tr>
<tr>
<td>• Less risk of freezing.</td>
<td>• Water management (quality and abstraction).</td>
<td></td>
</tr>
<tr>
<td>• New and expanded markets (e.g. detergents).</td>
<td>• Flooding and storm risk.</td>
<td></td>
</tr>
<tr>
<td>• Plant re-design opportunities.</td>
<td>• Loss of markets (e.g. for anti-freeze agents).</td>
<td></td>
</tr>
<tr>
<td>• Increased volatility of certain chemicals at higher temperatures.</td>
<td>• Inadequate cooling.</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lower energy bills in winter.</td>
<td>• Working conditions.</td>
<td>Incremental adaptive response to gradual changes and/or extreme events likely. Reality of changes for operations will have to be demonstrated to induce change.</td>
</tr>
<tr>
<td>• New design opportunities with attendant economic savings on heating, water and maintenance bills.</td>
<td>• Potential increase in energy demand for cooling.</td>
<td></td>
</tr>
<tr>
<td>• Higher energy use for summer cooling.</td>
<td>• Flood and storm risk increase.</td>
<td></td>
</tr>
<tr>
<td>• Increased maintenance (due to storms, etc.) and possible adaptive measures.</td>
<td>• Vulnerable historic buildings/artefacts.</td>
<td></td>
</tr>
<tr>
<td>• Water supply problems, especially for current irrigated farming.</td>
<td>• Running costs increase (e.g. insurance).</td>
<td></td>
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<tr>
<td>Buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• New markets and technologies.</td>
<td>• Flood and storm risk and effect on electricity distribution.</td>
<td>Statutory building standards below most other EU countries. Perceptions of natural resource use in construction beginning to change.</td>
</tr>
<tr>
<td>• Opportunities for non-fossil fuel energy sources under NFFO, e.g. bio-gas, wind, bio-mass, CHP, etc.</td>
<td>• Overheating of underground cables.</td>
<td></td>
</tr>
<tr>
<td>• Opportunities for energy efficiency and conservation.</td>
<td>• Localised extreme events and their impacts (e.g. storms).</td>
<td></td>
</tr>
<tr>
<td>• Flood and storm risk and effect on electricity distribution.</td>
<td>• Energy efficiency policy important (e.g. Standards of performance programmes). Shift in how energy as a resource is viewed.</td>
<td></td>
</tr>
<tr>
<td>• Variability of weather.</td>
<td>• Overheating of underground cables.</td>
<td></td>
</tr>
<tr>
<td>• Flood and storm risk.</td>
<td>• Localised extreme events and their impacts (e.g. storms).</td>
<td></td>
</tr>
<tr>
<td>• Running costs of tourist facilities (e.g. insurance).</td>
<td>• Energy efficiency policy important (e.g. Standards of performance programmes). Shift in how energy as a resource is viewed.</td>
<td></td>
</tr>
<tr>
<td>• Loss of amenity value from sea defences.</td>
<td>• Climate change impacts are likely to depend upon unforeseeable social, economic and cultural changes.</td>
<td></td>
</tr>
<tr>
<td>Tourism &amp; Leisure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Expanded markets.</td>
<td>• Climatic conditions.</td>
<td></td>
</tr>
<tr>
<td>• New markets.</td>
<td>• Running costs of tourist facilities (e.g. insurance).</td>
<td></td>
</tr>
<tr>
<td>• Benefits to other sectors through the ‘tourist multiplier’.</td>
<td>• Loss of amenity value from sea defences.</td>
<td></td>
</tr>
</tbody>
</table>
Some problems are responsive to adaptive measures. More intractable are those requiring large capital investment in pursuit of relatively marginal economic activities. 'Conservation' does not imply 'standing still'. Many ecological and socio-economic systems are fluid and dynamic and need to be managed as such.

### Insurance
- Expanded markets.
- New and expanded markets (flood and storm risk, new businesses, etc.)
- More sophisticated risk assessment methods and knowledge base.

### Water
- Rationale for forward planning.
- Leakage reduction, demand management favoured.
- Water conservation/efficiency favoured.
- Better catchment management.
- Infrastructure for waste water and effluent treatment improved and capacity enhanced.
- An expanded integrated supply network becomes more resilient to variability in rainfall.

### Transport
- More tourism increasing demand for transportation.
- Demand for railway journeys and water-based transport increasing (e.g. cruises on canals, rivers, lakes and sea).
- Some ports and harbours turned over to tourism/recreational purposes.

### Cultural
- Greater use of outdoor resources (parks, gardens, historic sites etc.).
- Greater income from recreational use.
- Reduced cost of warming buildings in winter.

### Public Policy
- Environmental awareness and resource use.
- Integrative thinking and planning.
- Organisational reform and partnerships.
- Regional economic transformation.

### Beneficial effects
- Higher uncertainty.
- Greater exposure to risk.
- Market differentiation.
- Possible future difficulty of obtaining insurance cover for some customers.
- Possible future difficulty of obtaining re-insurance cover.

<table>
<thead>
<tr>
<th>Beneficial effects</th>
<th>Detrimental effects</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Insurance</td>
<td></td>
<td></td>
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<tr>
<td>Water</td>
<td></td>
<td></td>
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<tr>
<td>Transport</td>
<td></td>
<td></td>
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<tr>
<td>Cultural</td>
<td></td>
<td></td>
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<tr>
<td>Public Policy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role of Government policy critical, e.g. on leakage reduction, water conservation, moves towards metering and demand management, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>More risk-based approaches emerging as scientific base expands. Future of 'equity' principle unclear.</td>
</tr>
<tr>
<td>More problems are responsive to adaptive measures. More intractable are those requiring large capital investment in pursuit of relatively marginal economic activities.</td>
</tr>
<tr>
<td>'Conservation' does not imply 'standing still'. Many ecological and socio-economic systems are fluid and dynamic and need to be managed as such.</td>
</tr>
<tr>
<td>Local Agenda 21; Local Environmental Agency Plans; Shoreline Management Plans. Need for 'climate headroom' to be included in decision making.</td>
</tr>
</tbody>
</table>
## The Degree of Sensitivity to Climate Change

### Degree of Sensitivity by Landscape Domain and Economic Sector

<table>
<thead>
<tr>
<th>Domain/Sector</th>
<th>Year</th>
<th>Impact (-5 to +5)</th>
<th>Confidence Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020s</td>
<td>2050s</td>
<td>2080s</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Coast</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Urban Core &amp; Urban Fringe</td>
<td>Low</td>
<td>Medium</td>
<td>Medium/High</td>
</tr>
<tr>
<td>Rural Lowlands</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Rural Uplands</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Low</td>
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<tr>
<td>Buildings</td>
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<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Energy</td>
<td>Low</td>
<td>Low</td>
<td>Low/Medium</td>
</tr>
<tr>
<td>Tourism &amp; Leisure</td>
<td>Low</td>
<td>Medium</td>
<td>Medium/High</td>
</tr>
<tr>
<td>Insurance</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Water</td>
<td>Medium/High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Public Policy</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium/High</td>
</tr>
<tr>
<td>Transport</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Cultural Heritage</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Confidence Levels:**
- most confident
- moderately confident
- least confident

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Regional Responses to Climate Change

The New Regional Picture

The formation of the Regional Chamber, the Regional Development Agency and the preparation of a new Sustainable Regional Economic Strategy presents an enormous opportunity for the North West to shape a sustainable Twenty-First Century. This study is offered as an initial contribution to that debate.

“There is every reason to expect impacts upon the region to become ever greater as the 21st Century progresses. Action must be taken now to limit future contributions to global warming.”

‘Climate Headroom’

Policy making across landscape domains and across the sectors dealt with in this study would benefit from incorporating climate change into future decision-making. Policy needs to provide sufficient ‘climate headroom’; that is leeway in planning operations and design specifications for changing climate variables and their subsequent impacts.

Step by Step

Many of the responses to climate change taken by both the public and private sectors will be incremental steps taken in response to gradual change and as a result of extreme events. More extreme events will often lead to radical changes in policy and behaviour as illustrated in the North West by the response to coastal flooding incidents experienced over the last 40 years.

Measures to improve or conserve valued regional assets and the North West’s natural landscape will be brought into sharper focus by the challenge of climate change. Policies which may appear unrelated to climate change impacts but which increase the resilience of these social and ecological assets are to be recommended.

Zero Impact: Hyndburn Borough Council’s planned Zero Energy Office Building will use renewable energy sources and energy efficiency to reduce global warming. [Jestico & Whiles Architects]
The Mandate for Action

This detailed research conducted within the region has revealed a clear interest in, and growing concern about the issue of climate change, a concern which delivers a clear mandate for a policy response. Potential policies that could be implemented include measures to limit greenhouse gas emissions. These policies would have significant impacts upon energy production and efficiency, with opportunities for the development of ‘renewable’ energy sources such as wind power, solar power, bio-gas, biomass, combined heat and power and hydropower. Incineration and nuclear power may also be considered by utilities as energy sources with a reduced impact upon the greenhouse effect.

More productive use of energy will save money as well as reducing greenhouse gas emissions. There are benefits to air quality, human health and employment from increases in energy efficiency and conservation. There is also the possibility of positively transforming the urban infrastructure in response to climate change.

Some policies will take decades to have their full effect, but the range of possible impacts identified in this report are for the 2020s, 2050s and 2080s and there is every reason to expect impacts upon the region to be even greater beyond these time scales. Action must be taken now, within national and international frameworks, to limit future contributions to global warming and to plan effectively for the climatic changes the region faces in the next millennium.
The North West Climate Change Impacts Study

The study which forms the background for this Summary Report has been conducted for the North West Climate Group by a team which includes The University of Manchester Institute of Science and Technology (UMIST), The University of Manchester, The University of East Anglia Climatic Research Unit, The Institute of Terrestrial Ecology and Lancaster University.

Preparing for the Future

A partnership of the public and private sectors has formed a pioneering new group – the North West Climate Group – to model and prepare for a warmer, wetter North West England in the 21st century. Rising sea levels, flood damage, extreme weather events, heavier and more intense rainstorms are just some of the likely impacts upon the region being assessed by the group which is working on behalf of the North West Regional Chamber.

A unique regional initiative, the North West Climate Group is a model for the rest of the UK. The Group commissioned a major study – led by UMIST and launched in December 1998 – which outlines the impact global warming may have upon the region.

A Partnership Project


Further Information

A full technical report of this study and further background papers are available on the North West’s dedicated environmental website, ENWWEB (http://www.snw.org.uk/enwweb).

A printed version of the report is available at a cost of £15 inc. P&P. Send a cheque, made payable to Sustainability North West, to:

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