EA-South West

Warming to the idea

Meeting the challenge of climate change in the South West

SUMMARY REPORT

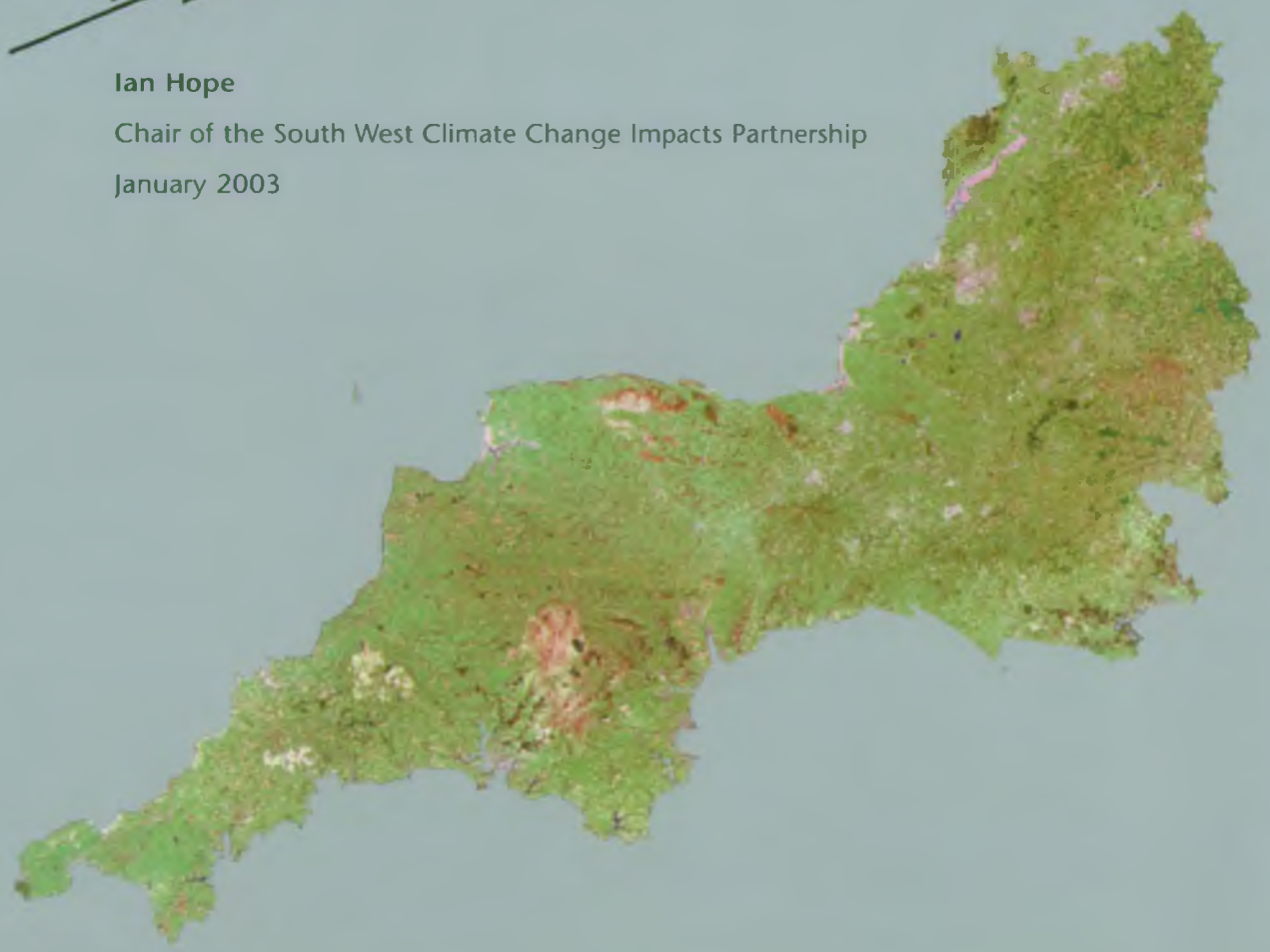
"This document reports on the likely effects of climate change on the South West Region. We are already having a significant effect on the earth's climate and we have no choice but to adapt to the chain of events that have been put in place. Our children and indeed their children will witness significant climatic changes which will affect many aspects of their lives.

I hope all of us in the South West will take on board the messages from this report. Whether in business, public service or as individuals we need to plan for the new weather conditions that have been predicted. We need to adapt to these changes and crucially we all need to modify our lifestyles so that we can minimise the risks of climate change for the South West, and seize the opportunities that it offers."

Ian Hope

Chair of the South West Climate Change Impacts Partnership

January 2003



Introduction

Coping with a changing climate is likely to be one of the greatest challenges of the 21st century as global warming makes its impact. Most people in the South West have heard of climate change, yet many do not know how it will affect their jobs, homes, lifestyles and environment.

Here in the South West climate change is bringing both opportunities and challenges now and will bring new ones in our children's lifetimes. Fishing crews are seeing new species in their nets, tourists are benefiting from warmer weather, farmers are already able to grow new crops. On the down side, severe flooding is happening more often, water resources are stretched and some plant and animal species are coming under increasing pressure.

What is crucial is how we adapt to our changing climate. We should welcome and make the most of the opportunities that climate change offers, while working in partnership to overcome the challenges it presents.

This report from key stakeholders in the region is a call for action. It summarises the likely impacts of climate change on the South West, and sets out what needs to be done to adapt to the impacts.

It is based on a scoping study commissioned by a partnership of key regional stakeholders, the South West Climate Change Impacts Partnership (SWCCIP). You can find out how to access the full study on the back page.

The main aims of the study were to:

- describe the climate change scenarios projected for the South West in the coming century;
- identify the likely impacts of such change;
- suggest actions to respond to the challenges and opportunities presented by these impacts.

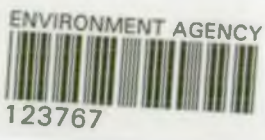
The study is a resource to help us all plan for the future and adapt to our region's changing climate. But it is only the start to an ongoing process of regional activity.

The SWCCIP will be taking forward the messages from the study and building them into decision-making for the South West.

The Global Picture

There is now no doubt that our climate is changing. The Earth is warming up and the last century was probably the warmest of the entire millennium.

The last 50 years of warming is largely man-made, caused by increases in the atmosphere of heat-trapping gases such as carbon dioxide and methane. If these 'greenhouse gases' increase, less heat can escape back into space and the natural greenhouse effect is enhanced, making the Earth warmer. More than 180 nations have ratified The United Nations Framework Convention on Climate Change, and almost 100 parties have ratified or acceded to the Kyoto Protocol, which sets legally-binding constraints on greenhouse gas emissions. Despite this it is still predicted that significant climate change will occur over the coming century due to greenhouse gases already in the climatic system.



Key messages for the South West

- Most individuals have heard of climate change but this awareness doesn't extend to businesses in the region.
- Where climate change influences an organisation's policy, it is mitigation (avoiding further climate change by reducing greenhouse gas emissions) rather than adaptation (responding to climate impacts) that features.
- In business, opportunities exist for new markets in tourism and leisure, outdoor activities, food and drink and renewable energy.
- Extreme climate events present challenges for all of us. For example buildings, transport and communication are vulnerable to flooding and storms, which is already leading to increased insurance claims.
- In the natural environment, opportunities exist now for new crops such as grapes, maize, sunflowers and soya, and for new types of habitat. In coastal waters new warmer water species are already present and more are anticipated.
- In the natural environment, challenges exist from sea level rise and changes in rainfall, such as coastal erosion, river flooding and reduced water availability in summer. There is a potential loss of species from coastal waters, and decisions must be made about seeking to retain rare sites and habitats in the face of a shifting climate.
- In our buildings, especially our housing, we will need to design for much warmer summers, providing cooling and ventilation, but without using any more energy that would make things worse.
- Alternative routes are required for key road and rail infrastructure to avoid locations that are particularly vulnerable to flooding.
- Some new opportunities exist for developing renewable sources of energy such as wind and wave power, solar power and bio-fuels.
- Local Authorities have a key role in adapting to climate change in their roles as service providers, corporate managers, and community leaders.

The South West - a special place

A great diversity in landscapes, wildlife, cultural heritage and economic activity makes the South West a special place to live, work or visit.

Nearly five million people live in the region, England's largest, which comprises Gloucestershire, Bristol, Wiltshire, Dorset, Somerset, Devon and Cornwall. Each year another 21 million visit the region and contribute £3.5 billion to its economy.

Residents and visitors alike enjoy its beaches and moors, its wildlife and famous gardens, its thriving cities and rolling farmland. Yet every aspect of our regional life faces an uncertain future because of climate change. Sector by sector, this report details the likely impacts of climate change during the 21st century.

Our region must address risks such as increased flooding and uncomfortable working environments, while making the most of opportunities such as an extended growing season and the scope for increased outdoor activities.

Our changing climate

The regional picture

Using climate scenario data from the UK Climate Impacts Programme (UKCIP), predictions for a range of variables such as temperature and precipitation (rain and snow) have been made for the 2020s, the 2050s and the 2080s.

The following two tables show:

- anticipated changes in the region's seasonal climate over the next 50 to 80 years;
- a summary of climate changes likely to affect the South West, variable by variable.

Future seasonal climate in the South West

Season	Seasonal climate *(the range of figures indicates Low and High Emissions scenario results)* 2050s	2080s
Spring	• Warmer by 1.0 to 2.0°C • Precipitation totals similar to now	• Warmer by 1.5 to 3.5°C • Precipitation totals similar to now
Summer	• Warmer by 1.5 to 3.5°C • Drier by 15 to 30%	• Warmer by 2.0 to 5.5°C • Drier by 25 to 55%
Autumn	• Warmer by 1.5 to 3.0°C • Drier by 0 to 10%	• Warmer by 2.0 to 5.0°C • Drier by 5 to 15%
Winter	• Milder by 1.0 to 2.0°C • Wetter by 5 to 15%	• Milder by 1.5 to 3.5°C • Wetter by 10 to 30% • Snowfall will decrease by up to 70 - 90%.

Summary of climate changes for the South West by the 2050s

Variable	Likely change *(the range of figures indicates Low and High Emissions scenario results)*
Temperature	• Annual warming of 1.0 to 2.5°C (Annual warming of 1.5 to 4.5°C in the 2080s) • Greater warming in summer and autumn than in winter and spring • Greater night-time than day-time warming in winter • Greater day-time than night-time warming in summer • Years as warm as 1999 (+1.2°C) become more common
Precipitation	• Winters 5 to 15% wetter (Winters 10 to 30% wetter by the 2080s) • Summers 15 to 30% drier (Summers 25 to 55% drier by the 2080s) • Heavy rainfall in winter becomes more common • Greater contrast between summer (drier) and winter (wetter) seasons • Summers as dry as 1995 (37% drier than average) become more common • Winter and spring precipitation becomes more variable • Snowfall totals decrease significantly
Cloud cover	• Reduction in summer and autumn cloud and increase in radiation • Small increase in winter cloud cover
Humidity	• Specific humidity increases throughout the year • Relative humidity decreases in summer
Soil moisture	• Decreases in summer • Slight increase in winter soil moisture
Storm tracks	• Winter depressions become more frequent including deepest ones
North Atlantic Oscillation	• North Atlantic Oscillation may become more positive in the future, bringing more wet, windy and mild winters

The maps over the next two pages show changes in the region's annual, winter and summer temperatures and precipitation for the 2020s, the 2050s and the 2080s relative to the 'baseline' period of 1961-90. They were modelled using UKCIP02 scenarios for high and low emissions of greenhouse gases.

Climate case study

Cheltenham

Temperature records in Cheltenham reveal a warming trend of 1°C over the last 60 years. Seven of the 10 warmest years recorded have occurred since 1989, and annual mean temperatures are higher today than in the 1940s.

Cheltenham currently holds the UK's record maximum temperature. From 1961 to 2000 there was a less than 10% chance of the daily summer temperature rising above 30°C. Looking ahead to the 2080s there is a 20% likelihood that this temperature will be exceeded.

Climate case study

Plymouth

Temperature records kept at Plymouth since 1874 show a warming trend of 0.5°C over the last 125 years. Four of the 10 warmest years within that period have happened since 1989, being 1989, 1990, 1995 and 1999.

From 1874 to the 1940s there was a warming of 0.8°C, followed by a cooling until the 1960s. The last two decades have shown a rapid return to the temperatures of the 1940s.

Plymouth's rainfall records show an increased trend since the drought of 1975-76, although there were also periods of increasing rainfall at the start of the last century and in the 1920s.

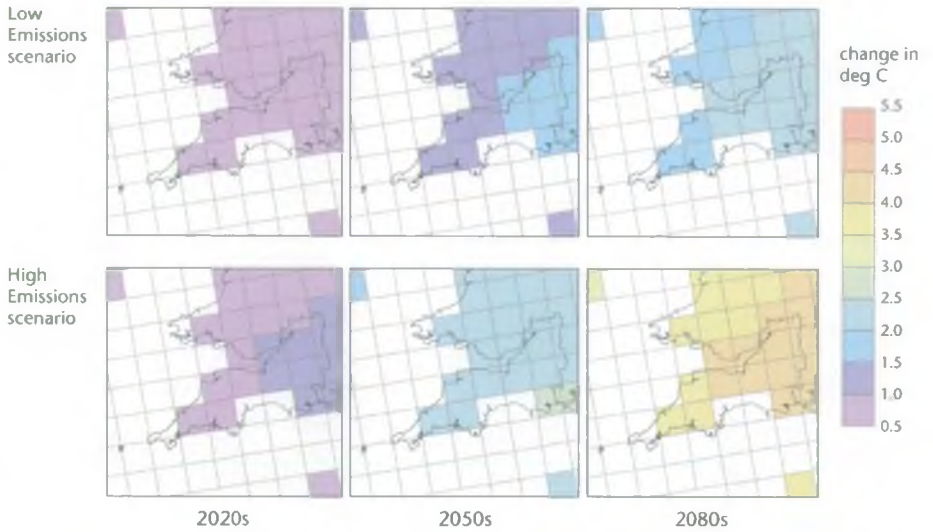
Temperature

Temperature

Changes in South West England average annual, winter and summer temperatures (as compared to the 1961-90 average) for the 2020s, 2050s and 2080s for the UKCIP02 Low Emissions and High Emissions scenarios. These are modelled results at 50km resolution for gridcells representing areas that are predominantly land.

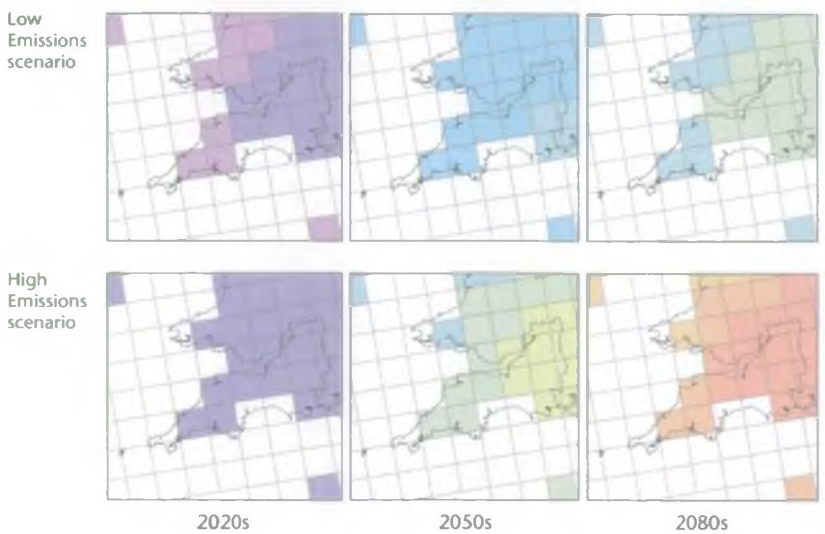
The world's leading scientists - the Intergovernmental Panel on Climate Change (IPCC) - warn that global temperatures could rise by between 1.4°C and 5.8°C by the end of this century.

Annual



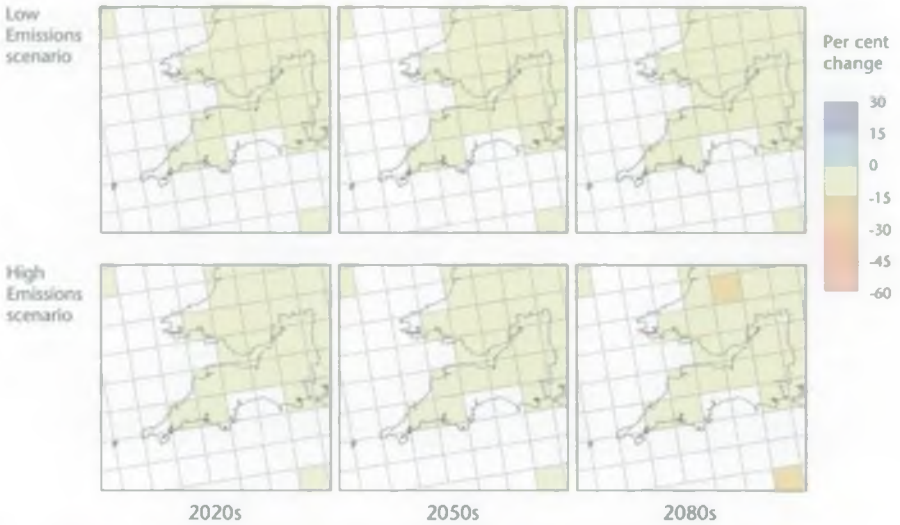
Winter

Summer

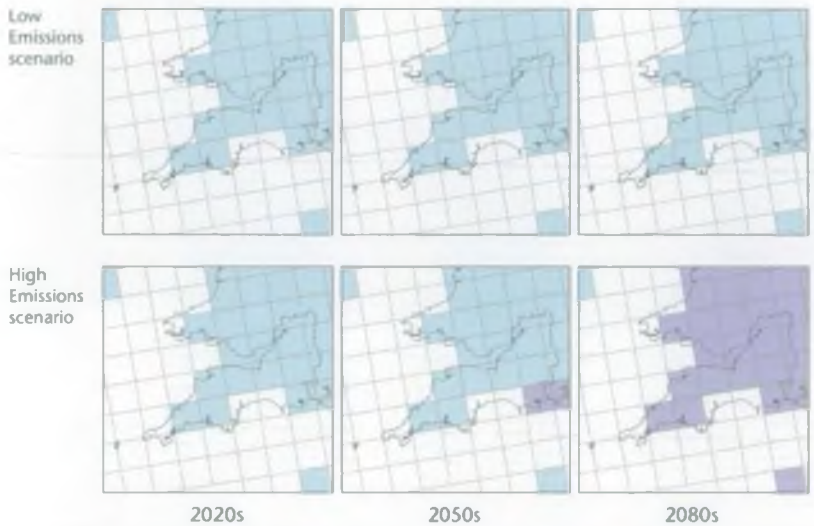


Precipitation

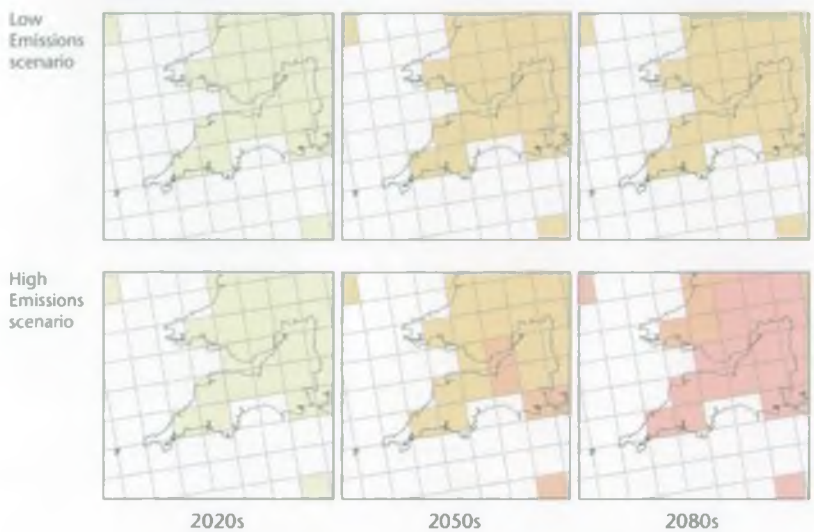
Annual



Winter



Summer



Precipitation

Changes in South West England average annual, winter and summer precipitation (as compared to the 1961-90 average) for the 2020s, 2050s and 2080s for the UKCIP02 Low Emissions and High Emissions scenarios. These are modelled results at 50km resolution for gridcells representing areas that are predominantly land.

Our climate has always been in a state of change but what is significant now is the rate of change and the reasons for it.

Our natural environment

'Farmers are already changing their buying patterns and adapting their practices'

Agricultural co-operative, Cornwall

One of the South West's greatest assets is its natural environment. It helps attracts tourists and accounts for about 13% of the region's businesses, in agriculture and related sectors.

Over a third of the region comprises national parks or areas of outstanding natural beauty, while much of the coastline is spectacular. The high quality environment attracts people to the region and helps drive economic development and regeneration.

The natural environment is susceptible to climate change in varying ways. For example, some plant and animal species may adapt while others may be eclipsed locally by new species colonising areas.

Among sectors covered by the South West Climate Change Impacts Scoping Study, the best informed were those dealing with the natural environment, such as water companies and nature conservation organisations.

Agriculture and horticulture

More than two-thirds of the South West land area is devoted to agriculture which employs 3.7% of the regional workforce. Agriculture and associated activities play a major role in maintaining the region's distinctive and varied landscape.

'Wood Cranesbill is an essential species in defining the upland hay meadow type in the interpretation of the EC Habitats Directive. Results from MONARCH suggest that this species may be lost from the South West of England by the 2020s'

Hossell et al., 2001

Key issues

- Higher carbon dioxide levels and a longer growing season will enhance growth of some crops and offer the potential for growing new crops such as sunflower, navy beans, sweetcorn, grapes and bio-fuels including vegetable oils.
- Potential increase in pests and diseases, including species new to the region.
- Increased need for irrigation, owing to reduced summer rainfall and higher temperatures.
- Potential loss of competitive advantage for South West agriculture.
- Intense rainfall in winter may increase direct and indirect damage to crops and soils, causing soil erosion, blocked drains and damage to rural roads.

Biodiversity, habitat, conservation & landscapes

There is a remarkable diversity of habitats and species across the South West. The region has some national rarities such as Cornish heather, and others found mainly in the region, such as the smooth snake.

Many habitats are islands surrounded by farmland through which native plant and animal species might have to migrate as the climate changes. Species in the region which are at the southern limit of their range might be more severely affected by climate change.

Key issues

- In a warmer climate, species at the southern edge of their range are most at risk of loss from the region.
- Warmer winters will adversely affect species suited to harsher winter weather.
- Species may migrate away from nature reserves or may be unable to, resulting in local extinction.
- Biodiversity is strongly influenced by land use, so policy responses should be developed in terms of integrated land-use management.

Coastal areas

The South West's long coastline is fundamental to its economy and its inhabitants' quality of life. It helps draw in 21 million tourists a year and attracts inward migration and investment. The region has nearly half of the UK's top beaches, as listed by the Marine Conservation Society's Good Beach Guide and more than 400km of National Trust coastline.

The national and international significance of its coastline is shown by the many environmental designations, including England's only marine nature reserve and Dorset's Jurassic Coast, the only natural UNESCO World Heritage Site in mainland UK.

'Storm events on the Isles of Scilly damage the whole economy.'

Key issues

- Rising sea levels, unpredictable coastal dynamics and possible increased storminess will increase coastal erosion and damage coastal amenities.
- Natural assets such as beaches, wetlands, mudflats, salt marshes and dunes may be lost and their flora and fauna will be affected.
- Protecting or relocating coastal assets may be too costly, therefore in some cases managed retreat may be the best option.
- Retreating from coastal areas in some locations, such as the Isles of Scilly, may not be viable, and protecting them will be very expensive.

Forestry

The South West includes historic woodland such as the Forest of Dean and parts of Exmoor, newer conifer plantations and large areas owned by the National Trust and the Woodland Trust.

Broadleaved trees are very susceptible to damage from major storms when in full leaf, while windthrow can be a serious problem for conifers at any time of the year, Any increase in the frequency of very severe storms will be a problem.

However, the forestry industry is familiar with the risk of extreme weather and is therefore generally well informed on the possible effects of climate change.

'Although established forest trees are broadly resilient to climate change, the establishment of new forestry (or new planting within felled forest) is more susceptible'

Broadmeadow 2002

Key issues

- New plantations could be affected by soil moisture deficits.
- There may be greater susceptibility to fungal diseases such as Phytopthera, particularly for coniferous species, more damage by green spruce aphid, and the prospect of new imported diseases taking hold.
- Floodplain forestry (eg short rotation coppice such as willow) may be a suitable adaptation for frequently flooded agricultural land.
- Higher carbon dioxide concentrations could increase growth rates and productivity.

'African species have recently been spotted off the South West including the sail-finned dory'

Tony Stebbing, University of Plymouth

Sea fisheries

Sea fisheries are an important part of the region's economy and 42% of England's fishing operations are in the region. For every person working in fishing there are another 3.5 jobs in processing and distribution.

Coastal waters of the South West mark a boundary between warm southern and cool northern seas which creates an abundance of species. Fish are particularly sensitive to small changes in temperature, causing changes in distribution at the extremities of their ranges. This may provide significant challenges to this important part of the local economy.

Key issues

- Rising global temperatures are likely to reduce the oceans' overall productivity, affecting species across the entire marine food chain. Such changes would increase pressure on fish stocks with serious consequences for South West fisheries.
- There is evidence that fish species are changing in South West waters, with new southern species in Cornish waters.
- With the North Atlantic warming, there will be significant losses of indigenous species to the North. Research has shown that cod populations fall as the seas warm up.

River flooding and drainage

Rivers vary widely across the region, from the chalk streams of Salisbury Plain via the sluggish, flood-prone rivers of the Somerset Levels and Moors to the fast-flowing Cornish rivers.

Climate change increases the risk of river and urban flooding in winter. The region saw its worst floods for 60 years during 2000/2001. At the same time, there is growing pressure for housing development on floodplains which presents challenges to local authorities and the Environment Agency.

'We need to start planning for 50 years plus but there are major problems in getting people to think this distance ahead'

Somerset Moors and Levels Partnership

Key issues

- The planning system needs to work to prevent further unsustainable types of development on floodplains with increased flood risk, and some existing activities may need relocation.
- The need for substantial extra housing provides a challenge to ensure sustainable urban drainage in a changing climate.
- River managers need scientific information to predict accurately the impacts on river flows. These include changes to flow patterns and changes in flood magnitude, frequency, seasonality and duration.
- Increased flooding could impact on other catchment processes including soil erosion, sediment mobilisation and yield and land slipping. This requires investigation.
- Land use practices that can exacerbate flood risks need to be identified and managed to reduce impacts.
- Design standards need to be re-appraised for both new and existing engineering structures and drainage systems.

Water resources and water quality

Over the coming century the region's water resources will come under greater strain as summer droughts potentially grow longer, demand for irrigation grows and water sources face possible increases in harmful organisms and nitrates. Reduced summer rainfall will mean that there is less water in rivers to dilute pollutants.

Potential impacts of climate change have been considered in depth by the region's water companies and the Environment Agency. These impacts will differ across the region because of variations in geology, topography, altitude and surface drainage.

Key issues

- Potential increases in demand for household, irrigation and industrial uses, as summer rainfall decreases and temperatures rise.
- Potential decreases in water supply as summer rainfall decreases and temperatures rise.
- Increased risk of flushing of nitrates and harmful organisms such as cryptosporidium into groundwater and watercourses in wetter winters with consequent impacts on water treatment requirements.
- Potential salinity increases in borehole and river-mouth abstraction points because of rising sea-levels and/or storm surges.

'Some projects have taken climate change into account at the design stage so that schemes that will be around for decades can be expected to withstand the changing weather patterns'

Network Rail

Our natural environment - Recommendations and actions

- Develop policy responses to address natural environment and biodiversity issues by considering integrated land use in coastal and marine management, in the context of dynamic habitats and changing landscapes.
- Review the potential loss of competitive advantage for South West agriculture.
- Monitor and manage the quantity, frequency and impacts of run-off from agricultural land, forestry and uplands.
- Increase awareness of climate change impacts in agricultural sector including opportunities for new crops.
- Encourage more research into, and monitoring of, coastal erosion.
- Rationalise split responsibilities for flood and coastal management and work towards more integrated management.
- Renegotiate Common Fisheries Policy in the light of species loss and relocation.
- Monitor and manage the impacts of changing quality in rivers, estuaries and groundwater and the consequent impacts on habitats and biodiversity.
- Review impact of longer droughts on water demand, eg modelled 4% rise in household water demand by 2021, and increased usage in agriculture and industry.
- Review sewerage and drainage infrastructure and control future developments in flood risk areas (including those arising from riverine flooding, flash floods, sewer flooding and rising sea levels).

Our society and infrastructure

Our region's physical infrastructure - its buildings, bridges, power lines, roads, railways - is vulnerable to most aspects of climate change. Long lead-times and investment periods mean that possible climate changes must be taken into account now by those responsible for infrastructure.

Changes in extreme conditions will have the greatest impact on infrastructure. The likelihood of extreme weather events will increase and it is these that will cause physical damage through flooding and possible storm damage.

Climate change will affect energy demand in the South West. Reduced heating demand in winter may be offset by increased demand for summer cooling. Opportunities for renewable energy such as wind and wave power and biomass are of particular importance to the region.

Our lifestyles could be influenced by climate change through choices of holiday destinations and timings, increased walking and cycling, more use of urban open spaces and increased exposure to the sun's radiation with associated cancer risks.

Built environment

There are potential threats to the built environment in parts of the region that are vulnerable to flooding and extreme winds and storms. Higher summer temperatures in parts of the region, especially the south, will lead to increased demand for cooling of buildings.

Milder winters will mean a reduced demand for conventional space heating in the south of the region. At the same time, increased solar radiation will provide the opportunity for solar heating in winter and cooling in summer.

'Is this a wind-up? I don't do science'

Local authority housing officer on receipt of climate change impacts questionnaire

Key issues

- Increased need for cooling of buildings in summer, especially in the south of region, but less demand for heating in warmer winters.
- Practical technologies needed for passive cooling of buildings, to avoid more releases of greenhouse gases in powering cooling plants.
- Increased use of existing water efficient technologies is needed to reduce water consumption in buildings, especially in summer.
- Increased solar radiation should improve performance and viability of solar-panels, photo-voltaic cells etc.
- Construction industry is ill-informed about, and ill-prepared for, climate change impacts. Wide ranging education and training is required.

Housing

For most housing professionals climate change is not on the agenda, yet it poses a host of challenges for the sector. New buildings will have to be designed to take account of factors such as increased clay soil shrinkage, the need for more ventilation, increased rain penetration and increased wind loads on roofs. Developers will have to avoid floodplains as the severity and frequency of winter flooding increases.

'Bury our heads in the sand for as long as possible'

Housing agency, asked how it will adapt to increased sea levels

Key issues

- Housing sector is generally ill-informed about, and ill-prepared for, climate change. Wide ranging education and training is required.
- Buildings on clay are vulnerable to subsidence and ground movement from clay drying and shrinking during drought.
- Balconies, parks and gardens will be at a premium, especially in high-density urban housing.
- Potential lifestyle changes from greater use of the external environment around buildings.

© David Mansell

'Incidences of skin cancer have increased in the last 10 years even with increasing awareness. Climate change is likely to continue this trend, particularly in the South West'

Medical professional, Bath

Health

Climate change is already impacting on our health, from the increased incidence of skin cancer in recent years to the reduced number of falls on ice because of milder winters. While primary effects such as these are well recognised, attention also needs to be focused on secondary effects such as the likelihood of more outbreaks of food poisoning due to the warmer summers.

© National Trust Photo Library / Ian Shaw

Key issues

- Warmer, sunnier summer weather is likely to encourage more outdoor leisure and lighter clothing, increasing exposure to the sun and risks such as skin cancer.
- Climate change will increase frequency of heatwaves which affect health and safety of workers, as well as causing short-term increases in mortality and ill health, in the sick and elderly.
- Milder winters should reduce winter mortality rates.
- Climate change is likely to increase frequency of winter flooding with long-term psychological impacts for those affected.
- Changes in rainfall patterns may increase risk of microbiological contamination of public water supplies.

Case study Dorset Coast

'We are losing the seasons - last year sea temperatures didn't drop below 10 degrees' - Dorset fisherman.

One result of the rises in sea temperature already being noticed by fishermen as well as scientists is that Manila clams are now thriving in Poole Harbour. Through competition for limited food the clams are displacing other species, including the economically-important mussels.

Local fishermen have had to shift from mussels to Manila clams, just one of the new species of shellfish and fish being caught all around the British coast. Poole has benefited from such changes: the new catches of shellfish are transported by road to the port and then shipped to Spain where there is a ready demand.

Traditional catches of cod, plaice and mussels used to be shipped by rail from Poole and other fishing ports. The switch to road transport has increased carbon dioxide emissions, and the rail spur to Poole harbour is threatened with closure.

NT gardener at Westbury Court Garden, Glos. © National Trust Photo Library / Ian Shaw

Heritage

© David Mansell

Our region is one of the UK's richest areas of natural and human heritage. For example it has almost half of England's Grade 1 listed buildings and nearly a third of the scheduled ancient monuments. Heritage is particularly important for South West tourism, attracting visitors to the region as a whole as well as to specific sites.

Key issues

- Increased visitor pressures and increased revenue for historic buildings from expansion in tourism in warmer climate.
- Potential increase in storm damage, light-degradation, rain damage, fungal and beetle damage to historic buildings.
- Maintenance of historical planting schemes will be difficult in gardens which were created in a colder climate.
- Changes to natural landscapes of heritage sites, National Trust land etc from climate-driven vegetational shifts.
- Archaeology in uplands could deteriorate as they dry out in summer, but sites in coastal locations may be lost as sea levels rise.

Case study Change in the city

Climate change will bring warmer, sunnier summers so shade in public places will become increasingly necessary – and it needs to be planned and designed for.

Local education authorities and school governors have begun to specify shaded external areas in plans for new schools, while existing school layouts will have to be modified. The cost will need to be included in school budgets.

Shade will also be important in city centre areas in response to changing lifestyles. Outdoor living and street activity will become a greater feature of life. In future Bristol may have to think of itself more like continental Europe with pavement cafes, and there will have to be more tree-lined streets.

Transport

Transport professionals in the region and elsewhere tend to pay greater heed to short-term weather problems, such as wind-blown leaves on rail track or snowdrifts, rather than the likely implications of climate change. When climate change is taken into account, it is more in terms of mitigation, such as reducing carbon emissions, rather than in terms of adaption.

Key issues

- Much of the transport sector has not yet significantly responded to climate change. The sector is more aware of the need to mitigate carbon emissions than of the need to adapt to climate change impacts.
- Some towns and cities are susceptible to periodic flooding and its frequency could increase, causing major disruption to road transport.
- Severe flooding may again sever the rail link near Exeter where flooding cut off the South West from the national rail network in autumn 2000.
- Railways along the coast are vulnerable to storm surges, high tides and cliff instability while tunnels are vulnerable to flooding.
- Motorway congestion could worsen if tourism increases with warmer summers.

'The rail network is vulnerable to flooding, and there are no rail diversionary routes from the Midlands to the Southwest or from Exeter to West Devon and Cornwall.'

Railtrack

Our society & infrastructure - Recommendations and actions

- Transport and utilities infrastructure companies to undertake risk assessment to identify vulnerable locations.
- Review opportunities for increased production of renewable energy – wind, water turbine, solar, biomass, wave, tide, biofuels.
- Use future predictions rather than historic climate data as basis for technical decisions when revising codes, specifications and regulations for design and construction of buildings and utilities and transport infrastructure.
- Undertake further research into lifestyle changes associated with climate change, and implications for socially excluded.
- Design new and existing buildings to anticipate reduced heating load in winter and cooling and ventilation requirements in summer, especially through the use of passive or low energy techniques.
- Increase awareness among those responsible for developing and managing housing stock.
- Include adaptation to climate change in developing strategies for sustainable construction.
- Encourage pedestrian and cycling modes of transport where improved climate conditions permit.
- Undertake feasibility studies for alternative and diversionary routes for strategic rail and road routes threatened by climate change and lobby nationally as appropriate.
- Review priorities for conserving and protecting threatened historical and natural heritage.
- Review potential demands on health provision from in-migration of elderly population as climate improves.

Our economy

Business activity will be significantly affected by climate change, whether through impacts such as increased flooding or through new market opportunities in tourism or environmental technologies. Climate change will also impact on infrastructure, supply lines and customers, which businesses depend on.

Very few business sectors, and even fewer individual businesses, currently consider climate change adaptation to be important. Mitigating climate change, on the other hand, has become increasingly focussed on businesses through the fight to reduce greenhouse gas emissions and in particular through the introduction of the Climate Change Levy which taxes the use of commercial, non-renewable energy. More awareness raising is needed to ensure businesses are at the forefront of climate change adaptation in the South West.

'This sector has the potential to benefit from development of new technologies in renewable energies, energy-efficient vehicles and flood defence'

Engineering company

Advanced engineering & aeronautics

The South West has many successful companies in the aerospace and advanced engineering fields which support clusters of component suppliers and other specialists. Businesses include the Airbus plant at Filton, Westland at Yeovil, Honda at Swindon and DML at Devonport.

Key issues

- Opportunities exist to develop engineering solutions to climate change impacts.
- Increased costs because of restricted water supplies and changes to energy costs.
- Increased downtime from loss of energy supplies and telecommunications during extreme climate events.

Biotechnology

Biotechnology is a growing sector in the region's economy. Large-scale climate change impacts on a global scale will highlight the need for drought- or flood-resistant crops and other biotechnological advances, providing opportunities for South West companies.

Key issues

- Health considerations, including increased solar radiation, heat stress and dehydration, will provide market opportunities.
- Direct impacts upon business activities include dust, heat stress on operatives and equipment damage.
- Demand for climate resistant crops and biological processes will increase opportunities for market development.

Environmental technologies

The South West has a growing reputation for developing renewable energy and other technologies that conserve or monitor the environment. More than 70 companies in Cornwall alone are involved in renewable energy and the region is often referred to as the 'Green Peninsula'.

Key issues

- Significant opportunities for developing and selling products and services to monitor, mitigate and adapt to the risks climate change may bring.
- Renewable energy provides opportunities for localised power generation reducing energy costs and the vulnerability of transporting power.
- Increased demand for consultancy services in managing climate impacts.
- Increased resource costs, including fossil fuel-based materials, and increased business costs.

Financial services

Financial services are an important sector in the region, with a large concentration in Bristol. Insurance companies are potentially vulnerable to the impacts of climate change, as shown by the extensive claims they faced following severe floods in 2000-2001. The full range of climate change impacts on all sectors will be felt by banks, in particular short-term impacts of extreme events.

'Globally insured losses have increased over 10-fold since the 1950s'

Intergovernmental Panel on Climate Change

Key issues

- Global as well as local impacts of climate change will impact on financial companies and their customers. Insurance companies are highly vulnerable to large losses from storms, droughts and floods.
- Warmer winters will reduce cold weather-related insurance claims, but there could be more subsidence claims in drier summers.
- Banks and building societies will lose income as customers incur losses from climate impacts such as disrupted supply chains.
- Properties in high risk areas, primarily floodplains and along unstable coasts, will lose value, and may become uninsurable or unsaleable, resulting in losses for lending institutions.
- Health impacts upon staff and those insured under health insurance schemes could be significant.

Food & drink

Food and drink processing and packaging is a major business in the region, supported by the high levels of farming and fishing. The huge influx of visitors has resulted in many companies trading in food and drink and exporting further afield.

Key issues

- Cooling methods need to be enhanced to avoid damage to produce and reduce bacterial build-up as temperatures rise.
- Changes to food and drink consumption patterns, including ice creams, cold drinks and salads in summertime.
- Increased visitor numbers to the region in warmer weather means a larger market, particularly for local specialities.
- New product opportunities such as increased wine production.

Information & communication technologies

'We have already had to move our server to the second floor because of flood risk'

Casella Cel Ltd

This sector has seen massive expansion in recent years and is an important contributor to the region's economy. Large international companies have located in the South West and led to the development of smaller businesses providing software, equipment and other products and services.

Key issues

- Damage to infrastructure, and consequent costs, particularly communications masts and overhead cables.
- Increased downtime from loss of energy supplies and telecommunications during extreme climate impacts.
- Increased market for technologies in mitigating and adapting to climate change, eg monitoring building temperatures and flood risks.

Marine engineering & marine activities

'Unenlightened attitudes are all too commonplace'

Garden design & maintenance company, Devon

Marine engineering has declined from its former prominence in the South West but is still an important employer and contributor to the regional economy, although primarily in small scale niche markets such as luxury yachts. By its very nature, this sector will be susceptible to climate change impacts on the coasts and seas.

Key issues

- Opportunities to develop engineering solutions to climate change impacts in coastal zones, such as new technologies to accommodate changes in sea levels and storm surges.
- Climate change impacts on infrastructure, particularly coastal-based facilities, supply lines and customers, will be acute.
- Opportunities to develop offshore and coastal renewable energies such as wind power and tidal barrages.
- Increased outdoor leisure will fuel demand for boats and other marine services.

Telemarketing

Telemarketing has expanded massively in recent years, with call centres and related activities replacing some of the region's traditional economic activities. It is very responsive to changes within businesses and can benefit from changes in marketing and products in other sectors.

Key issues

- Impacts of extreme climate events upon communication infrastructure, the main form of product delivery.
- Opportunities to market new products and services from other business sectors as a result of climate change.
- Increased opportunities to market government initiatives to mitigate and accommodate climate change.

© National Trust Photo Library / Ian Shaw

'Since 1974 there has been a clear relationship between July temperatures and the number of domestic holiday trips.'

Agnew 1999

Tourism & leisure

Tourism plays a vital role within the South West's economy, with over 21 million visitors in 2000, spending over £3.5 billion. The region's culture and environment attract 75% of visitors. Tourism supports about 225,000 jobs within 11,000 businesses.

Key issues

- Longer, more reliable summers and warmer winters extend the tourist season.
- Increased heatwaves and extreme weather in Mediterranean and other overseas tourism areas expected to bring increase in domestic tourism.
- Increased opportunities for outdoor recreation and warm weather services.
- Rising sea levels and flooding threaten beaches and coastal and riverside amenities.
- Health implications of increased heat stress, food poisoning and exposure to sun.
- Increased visitor and climate related pressures on the natural environment attractions, services and utilities.

Our economy - Recommendations and actions

- Co-ordinate the development of climate change strategies within individual business sectors.
- Carry out simple risk assessments appropriate to the scope of individual businesses based upon climate change scenarios (to include considerations of health, supply lines, infrastructure, insurance, litigation, customer demand etc).
- In individual companies investigate challenges and opportunities of climate change and identify managerial responsibility for addressing key impacts.
- Explore commercial opportunities for the business sectors in the South West recognising that markets will be influenced by climate change impacts on regional, national and global scales:
  - advanced engineering in developing 'flood-proof' infrastructure along coasts and rivers to accommodate higher storm surges and tides.
  - developing new technologies in renewable energy.
  - potential for biotechnology in adapting to new climatic conditions.
  - for environmental technology sector in monitoring and controlling environmental impacts.
  - new local crops and produce as part of regional and sub-regional strategies for marketing local food and drink specialities
- Encourage the insurance industry to be more open in its deliberations on emerging policy with regard to climate change impacts.
- Explore and monitor implications of global, UK and regional impacts on South West tourism and leisure and support the sector to exploit the opportunities.

Our Local Authorities

Local Authorities have a key role in preparing for climate change and adapting to its impacts. The publication 'Community leadership and Climate Change' helpfully identifies three principal roles for local authorities in relation to climate change.

As service providers local authorities are responsible for a range of functions which include:

Development Planning/Land Use Planning	Economic Development
Transport (GTPs)	Social and Economic Regeneration
Development Control	Education, Culture, Libraries etc
Housing (both as landlord and enabler)	Tourism and Leisure
Building Control	Urban Design and the Street Scene
Engineering including drainage	Environmental Health and Pest Control
Roads maintenance, snowploughs, salt, etc	Waste Management
Conservation of buildings, parks, trees etc	Emergency Planning

As corporate managers councils have responsibility for all of the functions that fall upon any large organisation. These include:

Buildings and other Estate Management	Risk Assessment and Management
Vehicles	Environmental Management
Procurement	Potential Litigation
Personnel Management	Health and Safety

As community leaders councils are called upon to be pro-active with regard to the following, both in a leadership role, and as examples of good practice.

Strategic Vision for community	Regeneration
Social, Economic & Environmental well-being	Sustainability Strategy for community
Economic Development	Climate Change Strategy for community
Community Planning	Nottingham Declaration on Climate Change

'We commit our council to work with key providers to assess the potential effects of climate change on our communities and to identify ways in which we can adapt'

clause from Nottingham Declaration on Climate Change

Local Authorities - Recommendations and actions

The following are recommendations for areas within which change can be initiated by local authorities:

- Support the national initiatives on climate change already begun by the Local Government Association (LGA), the Improvement and Development Agency (I&DeA) and the Society of Local Authority Chief Executives (SOLACE), including signing up to the Nottingham Declaration on Climate Change.
- Encourage officers in relevant local authority departments to pursue further climate change understanding through their networks of professional bodies, local government officers and the LGA.
- Encourage sub-regional groupings of county, district and unitary authorities to share best practice in both technical and managerial aspects of adaptation and to undertake a more detailed exploration of UKCIP climate scenarios and their implications for sub-regional locations.
- Explore the most effective policy framework(s) within which adaptation responses might sit. In particular, investigate the suitability of Local Strategic Partnerships (LSPs) and Community Strategies/Community Plans as appropriate vehicles.
- Consider the implications for their local communities of potential lifestyle changes resulting from climate change.

The Way Forward

The South West Climate Change Impacts Partnership is committed to taking forward the issues identified in their scoping study. The Partnership will work to ensure that consideration of climate change is built into strategic plans for the region.

This is only the beginning of an ongoing process to ensure the South West is at the forefront of progress towards adapting to climate change.

Recommendations and actions

- Review the role of the South West Climate Change Impacts Partnership to take forward regional work on climate change.
- Ensure that the main findings and recommendations of the Scoping Study are incorporated into current and future strategies and frameworks within the region.
- Ensure that the South West Climate Change Impacts Partnership continues to have an overall understanding of South West regional work on climate change impacts and adaptation, and to act as a focal point for that information.
- Encourage all organisations to identify appropriate policy frameworks within which to incorporate adaptation strategies.
- Increase awareness of the need for climate change adaptation across all sectors. Most stakeholders are ill-informed about, and ill-prepared for, dealing with the potential impacts of climate change.
- Ensure that simple messages are conveyed to the media because conflicting messages can create confusion on the direction and magnitude of climate change.
- Identify and take forward specific projects for action:
  - Review regional and sub-regional arrangements for emergency planning in anticipation of extreme weather events.
  - Co-ordinate the development of climate change strategies within local authorities.
  - Co-ordinate the development of climate change strategies within sectors in the region, such as sustainable construction, environmental technologies and biodiversity, particularly through the sector development programmes of the SWRDA.
  - Identify those issues at a regional level where central government action is required. Ensure that relevant standards and codes of practice are based upon the probabilities of future climates rather than the apparent certainties of historic data.
  - Undertake further research within selected sectors to better understand the significance of local impacts.

Summary of climate change impacts

Agriculture, horticulture and forestry

Opportunities

Longer growing season providing increased yields
Potential for new crops (grapes, navy beans, sweetcorn, soya and sunflowers)
Reduced frost damage should increase productivity
Potential increased growth rate (eg for forest trees)
Opportunities for new forestry planting in floodplains to mitigate flooding

Challenges

Reduced die-off of pests and diseases due to warmer winters
Decreased soil quality and increased erosion due to increased run-off from winter precipitation
Need for increased irrigation in summer
Possible wind and storm damage to standing crops and nursery stock
Increased heat stress to poultry and livestock
Potential loss of South West's competitive advantage

Coastal issues and marine fisheries

Opportunities

Increased tourism in coastal zones may boost local economies
Increased marine activity, water sports, surfing etc
Increased scope for aquaculture of new species of fish and shellfish
Some fisheries may be enhanced by longer breeding season

Challenges

Increased rate of coastal erosion and silting of estuaries
Loss of natural assets in the coastal zone eg wetlands and beaches
Reduced overall productivity of oceans, and loss of some commercial species (fish and shellfish)
Deterioration in water quality and increase in algal blooms
Increased run-off and leaching from land, damaging flora and fauna in coastal zones
Pressures arising from increased tourism in coastal zones

Biodiversity

Opportunities

Flora and fauna species with pronounced southern distribution to become more widespread
Integrated land management to aid nature conservation

Challenges

Risk to species vulnerable to drought
Risk to species requiring sub-zero period to break seed dormancy
Risk of expansion of naturalised aliens (eg Fuschia in Cornwall)
Increased visitor pressure on natural environment
Loss of coastal and estuarine habitats due to increased rate of coastal erosion and invasion
Threat to Chesil Beach and saline lagoon, and silting of estuaries
Increased incidence of fire in hot dry summers

River flooding and drainage

Opportunities

Introduction of sustainable urban drainage systems
Commercial opportunities in flood defence and flood management
Opportunity to integrate estuarine and coastal flood defence

Challenges

Increased risk of flooding from increased rainfall and possibly more storms
Improvements and higher specification required for flood defences
Improvements and higher specification required for urban drainage and rainwater disposal systems

Water resources and water quality

Opportunities

Increased supply available in winter but needs capturing and storing
Greater potential for one-season recharge of larger reservoirs and aquifers
Greater potential in winter for increasing water releases to hydropower

Challenges

Increased evaporative losses from surface water stores
Increased demand for water in summer
Higher concentrations of pollutants in watercourses from reduced summer rainfall
Increased risk of algal blooms and pollution in reservoirs with reduced water levels and low inflows in summer
Potential for saline incursions into coastal water abstraction plants and boreholes
Increased risk of sediment and pollution runoff into watercourses caused by changes in farm management practices adopted to adapt to climate change

Built environment and housing

Opportunities

Reduced heating demand, especially in winter, and therefore reduced heating costs
Commercial opportunities for developing regional expertise in passive solar heating, cooling, shading and other environmental technologies
Increased scope for outdoor activities around buildings, especially in summer
Increased potential for renewable sources of energy (eg passive solar)
Increased need for shading (eg more trees in urban streets and squares)

Challenges

Planning and design of new buildings in locations vulnerable to flooding
Potential overheating of interior environment in existing and new buildings in summer will require sustainable solutions to cooling
Increased subsidence and associated insurance claims due to drying out of substrata (especially in clay areas)
Structures under construction vulnerable to storm damage in exposed locations
Increased summer demand for water
Design standards will need to be revised in light of new climate scenarios

Summary of climate change impacts

Transport

Opportunities

Increased scope for walking and cycling for everyday travel and tourists
Improved rail and road infrastructure to provide alternative and diversionary routes in case of extreme climate events
Less frost damage to roads from winter cold; less need for road salting
Fewer ice/snow related accidents on roads and footpaths
Fewer ice/snow related points failures on railways

Challenges

Increased pressure on transport systems from more tourists
Flood risks (including flash floodsto roads) disrupting roads in some major towns
River/coastal flooding and landslip threats to railways
Increased threat of storm damage to road and rail
Some disruption to air traffic (eg air links to Scilly Isles and from Cornwall to London)

Utilities

Opportunities

Reduced heating demand, especially in winter may lead to lower bills for consumers
Commercial and environmental opportunities for developing renewable energy production (wind, tidal, bio-mass, bio-fuels, solar)
Commercial and environmental opportunities for passive solar heating, cooling, shading and other environmental technologies
Increased potential for renewable sources of energy (eg passive solar)

Challenges

Increased tourism, in summer and winter, will increase demand on utilities
Potential summer overheating of buildings will require sustainable solutions to cooling
Utilities infrastructure is vulnerable to storm damage in exposed locations

Health

Opportunities

Generally less ill health due to reduced cold conditions
Reduced winter mortality (eg from hypothermia)
Healthier lifestyles due to increased opportunities for outdoor activities
Fresh, healthy and locally-produced food available for a longer period
Less risk of injury due to falls on ice

Challenges

Increased risk of food poisoning
Increased risk of sunburn, heatstroke, and exposure to UV radiation (skin cancer)
Increased risk of heat exhaustion and dehydration in summer
Risk of deterioration in water quality and increase in infection
Higher air pollution in urban locations leading to respiratory disease
Increase in some diseases (eg Lymes disease from ticks)

Tourism and leisure

Opportunities

Longer, more reliable summer season leading to increased visitor numbers and visitor spend
Warmer winters, leading to a more year-round tourist season
More outdoor and water-related recreation
Potential increase in UK holidays, urban tourism and city breaks as Mediterranean destinations become too hot

Challenges

Increased demand on transport and utilities infrastructure due to increased visitor numbers
Coastal attractions vulnerable to sea level rise and storms
Increased visitor pressure on natural environment
Threats to historic gardens of changing habitat and species
Storm and flood damage to caravan sites and other tourist infrastructure

Environmental technologies and Biotechnology

Opportunities

Commercial and environmental opportunities for passive solar heating, cooling, shading and other environmental technologies and expertise
Commercial and environmental opportunities for pollution monitoring and control technology and expertise
Genetic modification of crops (eg to resist summer drought)

Challenges

Operational difficulties for equipment at high temperatures
Changes to water supply and quality will restrict water intensive activities
Increased demand for 'greywater', water treatment and new water-efficient technologies and expertise

Financial services

Opportunities

Reduced insurance claims arising from cold weather conditions
Investment opportunities resulting from increased economic activity (eg tourism)
Investment opportunities resulting from new market opportunities (eg environmental technology)

Challenges

Increased insurance risk due to flooding, landslips and subsidence
Higher insurance costs generally and potential for insurers not to provide cover to certain locations, premises, and activities
Increased insurance costs of storms and impacts on transport, infrastructure, business and property
Increased marine and offshore impacts and related investment and insurance losses

Food and drink

Opportunities

Availability of new crops and species in the region, reducing import costs
Developing new markets for local produce, especially new local varieties
Increased consumption of warm weather food and drinks leading to new markets

Challenges

Increased demand for cooling with associated environmental and financial costs
Increased bacterial build-up in foods leading to health risks and associated litigation
Loss of some traditional species and crops
Impacts on transport infrastructure especially ports, affecting distribution to and from markets

ATKINS

This report was commissioned by the South West Climate Change Impacts Partnership. It is a summary of a stakeholder-led Scoping Study carried out on behalf of the Partnership.

This study is one of a number linked to the UK Climate Impacts Programme which helps organisations assess how they might be affected by climate change so they can prepare for its impacts.

The South West Climate Change Impacts Scoping Study was carried out by:

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Further Information:

Copies of 'Warming to the idea', the SW Region Climate Change Impact Scoping Study can be found at www.oursouthwest.com/climate and at www.ukcip.org.uk/south_west/south_west.html

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