

Isle of Wight

C L I M A T E I M P A C T S

Report



2 0 0 9

Isle of Wight Climate Impacts Summary Report

November 2009

Status	Working Document
Issue Number	1

Produced by Island 2000 Trust, based on the Isle of Wight Climate Impacts Report written by The Footprint Trust on behalf of Isle of Wight Council.

Island 2000 Trust
Venture Quays
Castle Street
East Cowes
PO32 6EZ
www.island2000.org.uk
enquiries@island2000.org.uk
01983 298098

Cover photograph courtesy of Wendy North

Contents

Executive Summary	1
Section 1. Climate Change and Extreme Weather Events on the Isle of Wight	2
Section 2. Climate Change and Human Health.....	4
Section 3. Climate Change and Delivery of Public Services.....	6
Section 4. Climate Change and Infrastructure.....	8
Section 5. Climate Change and Business Continuity	9
Section 6. Climate Change and Tourism.....	10
Section 7. Climate Change and Agriculture	10
Section 8. Climate Change and Biodiversity	12
Section 9. Climate Change and Water	13
Section 10. References and Further Reading	15

Executive Summary

This report is a starting point for studying the effects of climate change on the Isle of Wight, leading to the development of adaptation plans. It brings together the relevant parts of a wide range of national, regional and local information and reports, wherever possible taking data which is specific to the Island.

The most overarching impact for the Isle of Wight is the effect climate change is likely to have on our domestic, agricultural and industrial water supplies including a reduction in quality and a lack of sufficient supply. This will affect all areas from public health and service delivery to the capacity of the fire service. A lack of water in the summer will be coupled by an increase in winter but delivered in intense rainfall events and storms of increased frequency and severity. The result will be more frequent and widespread flooding of lying areas. Flooding along the coast will be exacerbated by a rise in sea-levels and more severe storm surges, threatening our seaside towns and essential coastal infrastructure.

The higher summer temperatures will lead to a requirement to cool buildings to provide acceptable working conditions, but more seriously will lead to a higher occurrence of illness, increased incidences of food poisoning, cataracts and skin cancer, heatwave-related ailments and even deaths.

The Island's wildlife mix will undoubtedly change, with a number of species finding the Island no longer provides the habitats they need, possibly balanced by new species taking a liking to our warmer, drier climate. More pests and pathogens are likely to survive our milder winters threatening the balance of the Island ecosystem along with our own health.

The tourist industry could be one of the winners in the climate change battle through a warmer and drier shoulder season. One uncertainty in this area is the effect sea-level rise will have on our sandy beaches.

The future of agriculture is also uncertain within our changing climate. Crops are likely to benefit from an extended growing season, but farmers may have to change their crop mix as conditions alter and water for irrigation becomes less reliable.

This report concentrates on the impacts in the near future (up to 20 years) but also looks further ahead where reliable data exists. The next step will be to look at the impacts which are posing the greatest threats to Island life as we know it and to plan adaptation to mitigate the effects and where possible take advantage of new opportunities.

Section 1. Climate Change and Extreme Weather Events on the Isle of Wight

A gradual increase in temperature along with a change in the pattern of precipitation will bring hotter drier summers and milder wetter winters. There will probably be some shifting of the seasonal weather trends, such as early and late frosts. There will also be a gradual rise in sea levels as much as 50cm by the 2080s.

Climate Change

The following Key Findings for the Isle of Wight are taken from the work of the Defra UK Climate Impacts Programme¹, using the latest figures from UK Climate Projections 2009 (UKCP09)². The predicted figures below (unless otherwise stated) are for the 2020s (2010 to 2039) using a “medium emissions scenario” (i.e. taking predictions for future climate change emissions resulting from population growth, technological changes, economic growth etc). They are all relative to a baseline of 1961 to 1990. This timescale is important because whatever actions we take now to reduce the effects of climate change are for the more distant future – they will have little or no effect between now and 2030¹³. In other words this is going to happen whatever we do. This makes the need for well-informed and practicable adaptation an essential component of local authority strategic planning

Temperature

An increase in 1 or 2 °C may sound small, even pleasant, but average temperatures today are only 5°C higher than they were at the peak of the last ice age.¹ As shown in figure 1 below, mean annual temperatures are likely to be 1.4°C hotter within the next 20 years, though the projections state the figure could be as high as 2.2°C.

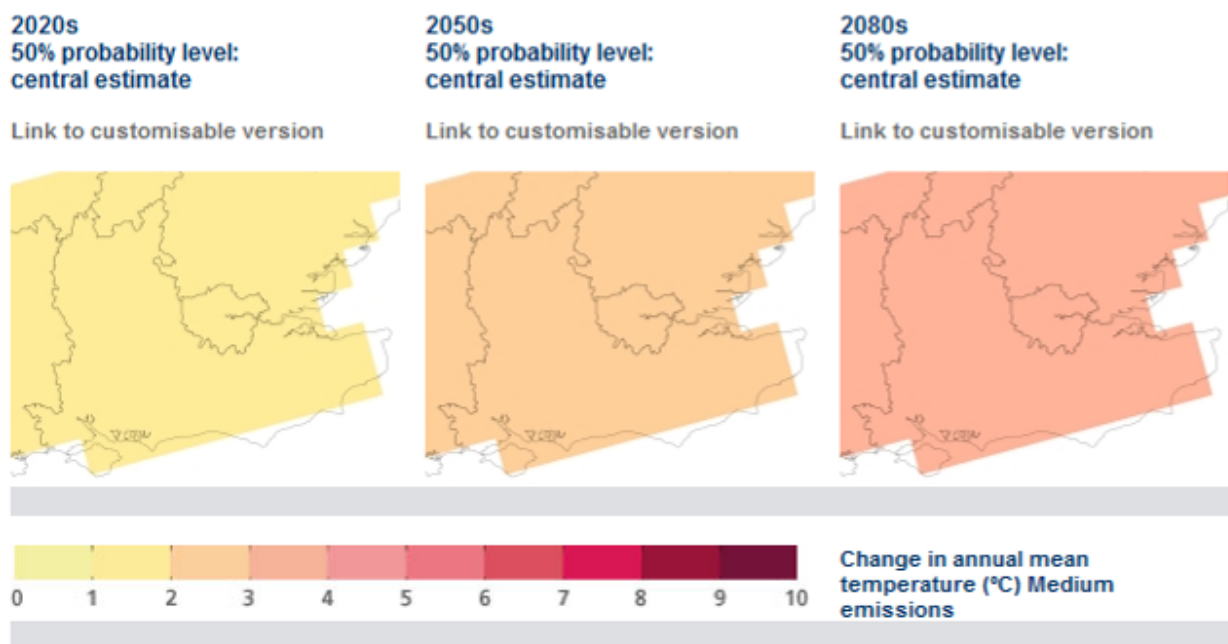


Figure 1 Change in Annual Mean Temperatures
Source: ukclimateprojections-ui.defra.gov.uk

Increase in average winter temperature – the central estimate for the 2020s is 1.3°C (very unlikely to be less than 0.6, and very unlikely to be more than 2.2) increasing for the 2050s to 2.2°C and for the 2080s to 3.1°C.

Increase in average summer temperature – the central estimate for the 2020s is 1.6°C (very unlikely to be less than 0.6, and very unlikely to be more than 2.8) increasing for the 2050s to 2.8°C and for the 2080s to 3.9°C.

Precipitation

Winter

Figure 2 shows precipitation during the winter will steadily increase – the central estimate for the 2020s is 8% higher (very unlikely to be less than 0%, and very unlikely to be more that 25%) increasing for the 2050s to 17% and for the 2080s to 22%.

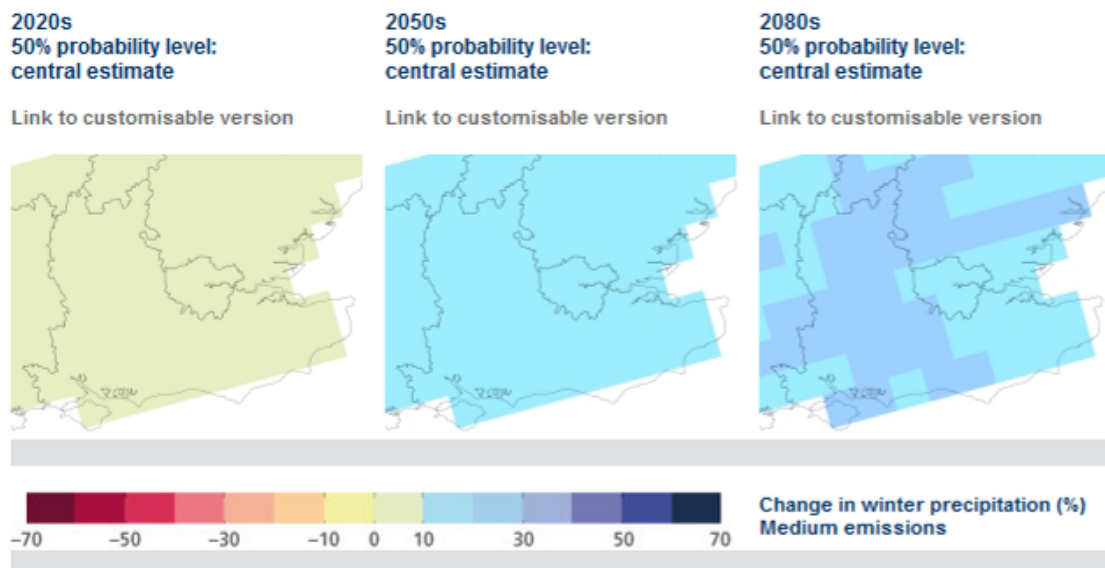


Figure 2. Change in winter precipitation
Source: ukclimateprojections-ui.defra.gov.uk

Summer

Figure 3 shows the projected decrease in average summer precipitation – the central estimate for the 2020s is an 8% decrease (unlikely to be less than 0%, and very unlikely to be more than -28%) the projected central estimate for the 2050s is a decrease of 17% and for the 2080s to 21%.

This is based on summer precipitation figures of about 1.5mm per day.

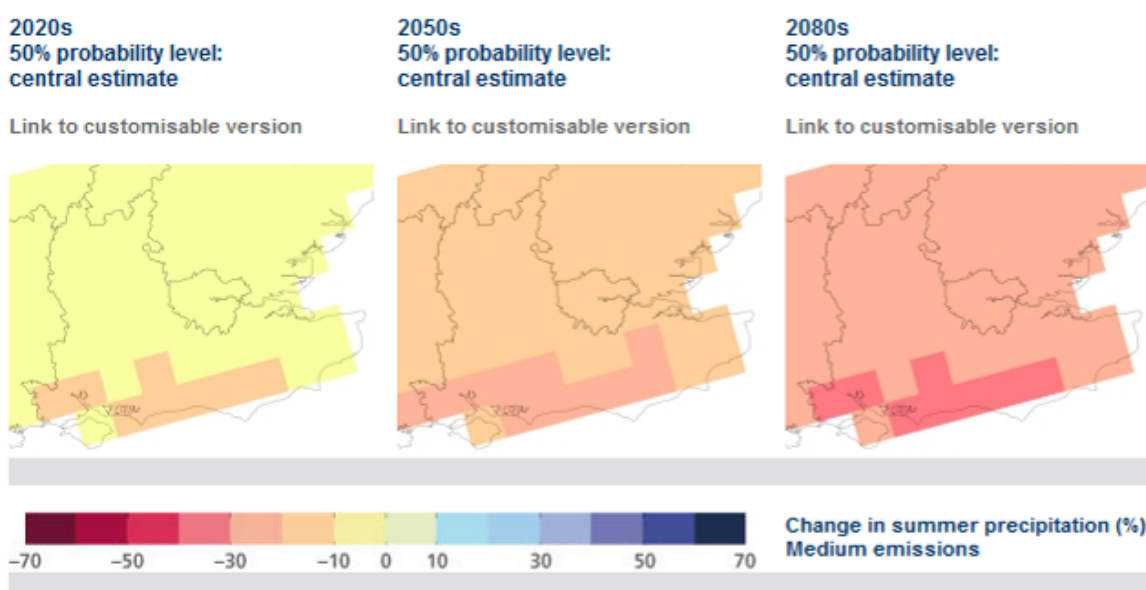


Figure 3. Change in summer precipitation
Source: ukclimateprojections-ui.defra.gov.uk

Sea Level Rise

Sea level along the Hampshire Coast had been predicted to rise at a steady 6mm/yr but is now expected to rise exponentially (4mm/yr until 2025, 8.5mm/yr until 2055, 12mm until 2085 & then 15 mm/yr).

This means that the net effect for both normal and extreme sea levels will be an increase of 0.4m by 2055 & 1.2m by 2115.

“Sea level rise is now a 'reality' that cannot be stopped in the foreseeable future. Communities need to start thinking now about how they can adapt to sea level rise and its consequences for them over the next decades”¹.

Adding slightly to the effects of sea-level rise on the Island is the fact that land in the South of England is dropping at a rate of about 1mm/year. This is due to the earth’s surface re-adjusting to the melting of the last ice sheets in Northern Europe.

Extreme Weather Events

More dramatic than the gradual effects of Climate Change above, and probably more disruptive to many services and organisations, will be the increase in the number of extreme weather events. These are less easy to predict with any certainty, but will include droughts, heatwaves, heavy rain and flooding, extreme cold spells, high winds and storms. For each of these events there will be an increase in their frequency, severity and duration.¹⁰



Increases in extreme weather events are likely to impact on many aspects of life (Image: Cheltenham Borough Council)

The Pitt Review¹¹ was written as a reaction to the floods of 2007. It refers to “the wettest summer since records began” and the fact that “events of this kind are expected to become more frequent”.

“To put the events into context, there were over 200 major floods worldwide during 2007, affecting 180 million people. The human cost was more than 8,000 deaths and over £40 billion worth of damage. But even against that dramatic back-drop, the floods that devastated England ranked as the most expensive in the world in 2007”.

For more information on areas of the Island at risk of flooding, refer to the IW Strategic Flood Risk Assessment of 2007¹².

Examples of extreme weather events which have hit the Island in recent years are included in the LCLIP (Local Climate Impacts Profile). As one recent example, a Storm Surge on the 10th March 2008 caused by a very deep depression (965mb) together with extremely high winds in the English Channel. The effect on the Island was that Yarmouth Harbour was flooded as the water height reached 1.1m above the predicted high spring tide.

Section 2. Climate Change and Human Health

There is a 1 in 40 chance that by 2012 SE England would have lived through a severe heatwave that would have killed some 3,000 people by heat-related deaths.³ In terms of conventional thinking about risks to health a risk of 1 in 40 is high. The most recent (4th) report of the Intergovernmental Panel on Climate Change highlighted a wide range of implications for human health. Sudden changes in the climate can cause death and disease through ‘natural’ disasters, such as heatwaves, floods and droughts. Allergies and food poisoning, which are sensitive to changes in temperature and precipitation, will also increase¹⁴. Climate change already contributes to the global burden of disease, and this contribution is expected to grow in the future¹⁴.

Extreme cold – in the short-term

In the long term, average winter temperatures are expected to rise. In the short term however, extreme cold snaps are anticipated, and therefore one issue that must be addressed is the potential increase in excess deaths during winter months.

Excess winter deaths are defined by the Office for National Statistics as the difference between the number of deaths during the 4 winter months (December to March) and the average number of deaths during the preceding autumn (August to November) and the following summer (April to July). It has been suggested that for every 1°C that the winter temperature drops below the average, there will be an increase of 8,000 excess winter deaths in the UK⁶. For the period of 2007-2008 the number of excess winter deaths in the UK was 25,300 and with the winter of 2008-2009 the coldest in 10 years it is expected that this number will be higher when reported⁷. It is unusual for cold to kill people directly in the UK; in the majority of cases these deaths are from respiratory or cardio-vascular complaints: heart attacks, strokes, bronchial and other conditions, and may arise or be exacerbated after exposure to the cold⁸.

Cold-related deaths on the Isle of Wight are greater than the English average. They stand at 0.83 per 1,000 of the population compared with 0.53 per 1,000 for England. This particularly affects single parent households, pensioners surviving on benefits and other low-income groups although it is found across all social classes. The total deaths on the IW per annum as a result of the cold are around 115.

Extreme Heat

Extreme heat is dangerous to everyone, especially older people. During a heatwave, when temperatures remain abnormally high for longer than a couple of days, it can prove fatal and climate change means that heatwaves are likely to become more common in England¹³. In one hot 9-day period in southern England in August 2003, there were some 1315 extra deaths¹¹. In a heatwave, it is mainly the high-risk groups who are affected, particularly care home residents¹³. However, during an extreme heatwave such as the one

affecting France in 2003, normally fit and healthy people can also be affected¹².



Cold spells may become a thing of the past. © Footprint Trust 2008

Increased UV Radiation



Sunny days are ahead – as are the risks from too much exposure to UV radiation © Footprint Trust 2004.

More than 75,000 new cases of skin cancer are diagnosed in the UK each year. Over the last few decades the incidence of skin cancer has increased dramatically. Recent research predicts that the incidence of melanoma skin cancer will treble in the next 30 years, with climate change likely to exacerbate the problem¹⁶. Climate change could cause an extra 5,000 deaths from skin cancer every year¹⁷. Some 2000 more cases of cataract may be expected each year. Increased levels of serious sunburn will also occur, requiring first aid and then medical treatment. Children are at particular risk¹⁸ as are the elderly of which there is a significantly high number of on the Island.

Food poisoning

There is a high incidence of food poisoning in the summer and fewer cases during the winter, which leads to the conclusion that the longer hotter summers could result in large increases in the incidence of food poisoning. This is supported by the Government's Chief Medical Officer who suggested that the exceptionally large number of cases of food poisoning in England and Wales in 1989 could have been partly the result of the unusually long, hot summer²⁰.

Pests

It is possible that indigenous malaria may be re-established in the UK by 2050²¹. It is not possible to predict the effect of climate change on the abundance of ticks in the UK; warmer and drier weather is likely to have a number of effects on the biology of ticks and some of these will run counter to others. Human contact with ticks is likely to increase as a result of changing land use for agricultural and recreational purposes. There may be a change in the proportion of ticks infected with the *Borrelia* genotypes which cause Lyme disease²¹. Milder winters are likely to allow more pests and pathogens to survive which would previously been killed off by frosts and prolonged cold spells.

Injury

The predicted increase in the frequency of severe gales is likely to be associated with significant damage to buildings, trees and people. Injuries resulting from people being blown over in high winds is likely during severe windstorms. An increase in traffic accidents is also probable. Analysis of a worst-case scenario - a windstorm in the late afternoon in London and southeast England - suggests that such an event might be associated with several hundred deaths, several hundreds of admissions to hospital and many minor injuries.

Air Pollution and Climate Change

Whilst winter will see a reduction in air pollution, due to there being fewer wind-less days, summer pollution will increase. On hot sunny summer days there may be an increase in background concentrations of ozone.

Section 3. Climate Change and Delivery of Public Services

The Chartered Management Industry Survey of 2008 said "In 2007, 28% of businesses were disrupted by extreme weather. This is likely to increase as our climate continues to change".

"Climate changes are likely to be most pronounced in the south and east of the country due to proximity to the continental land mass."¹

People

Staff in all services, and particularly those working outdoors, will be affected by the increase in average temperatures and an increase in heatwaves. This could lead to reduced productivity, greater UV exposure, heat stress and other health and safety issues. They may also be affected by a new range of health issues which will come with climate change. Travel problems (caused by storms or flooding) could prevent employees from getting to work.

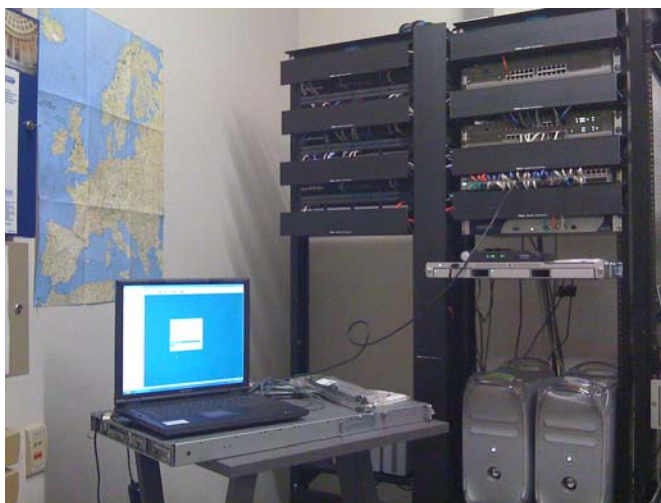
Buildings & Premises

Coastal properties are likely to be affected by rising sea levels and storm surges. Low-lying properties are at risk from river and surface water flooding, and rising ground water levels. There will be problems in keeping internal temperatures at comfortable levels. More subsidence and heave will occur due to drier summers and wetter winters, particularly an issue for the clay soils common over much of the Island. There will be ground instability following intense rainfall runoff, this is of particular concern in Ventnor, one of the largest developed and inhabited landslides in Europe. Long periods of dampness may cause moisture and condensation damage. There will be more structural damage due to high winds and storms. Insurance will

become more expensive or unavailable in certain areas. On the positive side there should be a reduction in the energy needed for heating.

Loss of Power

Power rationing and outages will be increasingly likely, because of storm and flood damage and because of excess demand, particularly for cooling systems during heatwaves. This loss of power may result from local Island sub-stations being put out of action or from pressures on, and damage to, the grid as a whole. Particularly hard hit will be communications and IT (which is also dependent on air conditioning), and possibly water supplies and sewerage if the cuts are for long periods. Mobile phone networks will eventually fail.



Power outage may impact critical IT systems (Image: Aaron Landry)

Environmental Health

There will be increases in food poisoning, water related diseases, insect-borne diseases and air pollution. See separate section on Health.

Grounds maintenance and Parks

There will be more flooding and water-logging in winter, along with more soil erosion. Summer droughts and water-shortages will create problems. Changes to the seasons will affect maintenance schedules for mowing, pruning, weeding etc. There will be different pests and diseases, and more harmful alien plants. On a more positive note there will be opportunities to grow different species. See the separate section on Biodiversity.

Fire and Rescue, and Police

Hotter drier summers will bring an increase in grassland and forest fires, which will mean more, often prolonged, pressures on the Fire & Rescue Service. These pressures will be made worse by the shortages of water which will be experienced. In the winter there will be more flooding and an increase in storm damage, which will result in more emergency calls. Emergency vehicles will have more difficulty in getting to call-outs if the transport network is affected.

Social Care

The elderly, and other vulnerable groups, are more adversely affected by heatwaves and flooding. This will increase the workload of the services and organisations which care for them, and perhaps change some of their priorities. It will also put more pressure on care homes.

Conservation and Heritage

Historic buildings and sites are particularly vulnerable to the effects of climate change, such as coastal erosion, flooding, rainwater penetration, storm damage, and the increased risk of fires.¹

Waste

There will be more odours and vermin as increased temperatures affect biodegradable waste.

Severe weather events could disrupt collections while waste awaiting collection may be soaked, and even washed away, by heavy rain and flooding, and blown around by higher winds. Waste sites could be flooded, and there is an increased risk of erosion and instability at disposal sites.

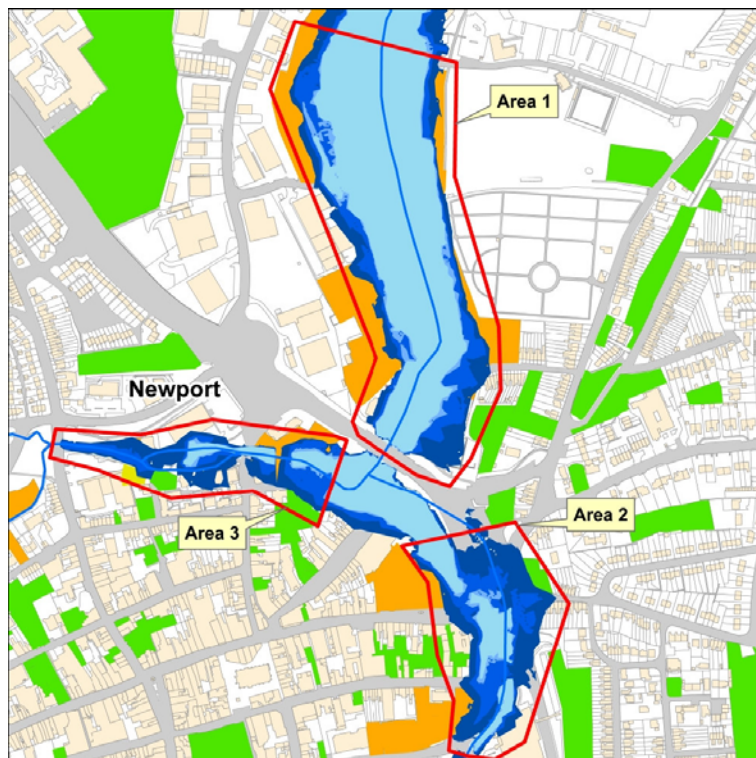
Planning

As new construction is prevented on flood plains and areas susceptible to coastal flooding, there will be more pressure to build on other areas of the Island. There will be a need to plan projected changes in climate into the architecture of new builds which will in turn require a change in the consideration of planning applications by the local authority.

Section 4. Climate Change and Infrastructure

As highlighted in the RESPONSE report², the hazard of coastal erosion exacerbated by climate change may present a range of impacts including loss of life, property, infrastructure and land. Destruction of manmade and natural sea defences, resulting from rising sea levels coupled with more severe storms, will lead to flooding inland.

Below is a diagram for the predicted flood zones in Newport. The Isle of Wight Strategic Flood Risk Assessment, from which it is taken, has similar diagrams for other areas of the Island.



Predicted Tidal Flood Zone 2 extents for the years 2026, 2070 and 2115 in Newport. Isle of Wight Strategic Flood Risk Assessment. Isle of Wight Council November 2007. (© Entec UK Limited 2007)

Power Failure

Probably the most extreme scenario is an Island-wide loss of electricity. The high voltage electricity transmission network in Great Britain has never experienced a complete shutdown in its history. However, the 1987 storm put the grid in danger of collapse due to damage to transmission lines.

Road, Rail and Bus

The Island's road network can be compromised by severe rain or snow. This will be compounded by increased instances of flooding, storm surges and gale force winds leading to wind throw of trees on to highways. In the summer flash floods are possible or tarmac melting in the heat making roads impassable. Railway lines will be affected by extreme temperature, heavy rainfall flooding tracks and tunnels, or causing embankments to collapse. The increased frequency of these events would impair rail and road transport.¹³ Roads which are near to the coast and particularly those in the Ventnor area, are vulnerable to the effects of landslips or flooding, which will increase due to the combined effects of heavy rain and coastal erosion.

Health Services

Climate change is "the biggest global health threat of the 21st Century", according to a leading medical journal¹⁵. The Lancet, together with University College London researchers, has published a report outlining how public health services will need to adapt¹⁵.

Providing power was not cut for a long period, St Mary's Hospital would still be able to function, as it has its own Combined Heat and Power gas turbines, but would probably cancel non-urgent appointments and procedures. The main problem might be staff getting into work if roads were blocked due to storm conditions. Ambulances may similarly find it difficult to reach people needing assistance⁵. The mobile phone network will be affected by any lengthy power failure and landlines may not work due to storm damage or flooding⁵ impeding communications between emergency services and the public.

Section 5. Climate Change and Business Continuity

The Chartered Management Industry Survey of 2008 said "In 2007, 28% of businesses were disrupted by extreme weather. This is likely to increase as our climate continues to change".

These are some of the issues which need to be considered:

Physical factors

Flood damage is likely to affect facilities based in low-lying coastal areas, along with inland facilities built in areas at risk from river flooding. There will be more storm damage to structures. Wetter winters and drier summers will lead to more subsidence and ground heave, particularly on clay soils, causing damage to buildings and other facilities. Increases in water costs and a decrease in availability of water will have a dramatic effect on some businesses.

Loss of power

Power rationing & outages will be increasingly likely, because of storm and flood damage and because of excess demand, particularly for cooling systems during heat waves.

These will particularly hit communications and IT, if widespread electricity outage occurs. According to the National Risk Register the secondary effects of power loss can include:

- loss of mains water and sewerage after six hours;
- loss of mobile communications after one hour, depending on back-up arrangements;
- disruption to financial transactions;
- closure of petrol stations.¹

Damage to infrastructure

An increase in flooding, storm damage or snow events will affect roads and the transport network, stopping deliveries and collections and preventing staff from getting to work.

Intense storms could lead to the Island being cut-off from the mainland for prolonged periods, leading to shortages of essential supplies. This will be made worse if the mainland road network, particularly in the South of England, is disrupted. Stocks of materials and supplies (including fuel and food) are often kept at low levels for economic reasons.



Fallen trees caused by extreme weather events are likely to disrupt transport infrastructure (Image johnthescone)

Economic factors

Fuel prices, and ultimately food prices, are likely to rise considerably. Services which rely heavily upon the use of transport, and incur high electricity and gas costs, are particularly vulnerable. Significant rises in Insurance costs can be expected, as claims for floods and storm damage increase, and in certain areas insurance may not be available.

Employees

Travel problems could prevent employees from getting to work, particularly key workers. Working from home may be an option for some, but corporate systems cannot always cope with large numbers opting to do this. Some employees, including those working outdoors, will be affected by extreme temperatures, particularly those with medical conditions. Staff could also be affected by a new range of health issues which will come with climate change.

Section 6. Climate Change and Tourism

On balance climate change may offer more opportunities than threats to the Island's appeal to tourists. Warmer drier summers, with a longer, more reliable, tourist season offer the opportunity to attract more people. There will, however, be more competition for tourists from Northern European regions.

The rise in sea-level means that beaches may get narrower and marinas, quays and coastal paths will be affected. Every 1 mm sea-level rise results in a 50-100mm retreat of the shoreline (there will be even greater erosion along our soft cliff stretches). It is possible that there will be an increase in long-shore-drift material, replenishing beaches. Each beach is different, with varying geology, topography and sea defence; all affect whether coastline will be lost, gained or remain the same.

A rise in temperature could result in a decline in coastal water quality which could affect the traditional 'bucket and spade' market. Changes to the Island's flora and fauna resulting from climate change may prove to be a negative impact on special interest and 'eco-tourism' markets or may become a new opportunity. The location of the island might mean that potentially appealing changes in seasonal weather (e.g. early springs) and the appearance of new and 'exotic' species occur here first in the UK. Extreme weather events will affect caravan and campsites, and festivals, along with travel disruption.

Section 7. Climate Change and Agriculture

Changes in temperature, precipitation and weather events will all impact on those who work on the land and sea. In a survey conducted in September 2008, 60% of farmers in England said that they were already affected by climate change and 63% said they expected to be affected in the next 10 years¹. Higher CO₂ potentially improves the carbon partitioning and photosynthesis within the plant, which in turn could increase farm productivity. The consequences of climate change will impact on different segments of the industry in differing ways.

Deluge and drought

The increased threats of drought and flooding from extreme weather events will all drive changes to farming practice. Extreme weather events could cause the loss of crops and livestock; indeed the increased significance of river flood plains and estuaries could see the retreat of farming from these areas due to the heightened flood risk. Even on higher ground some soils may suffer from poaching or water-logging in heavy precipitation which could result in late-harvesting, poor animal health, damage of autumn and winter cultivations and increased pest and disease problems. Drought conditions would have a serious impact upon all in the sector; not least with the increased risk of wildfires on the countryside and farmland.

Dairy Farming and Livestock Production.

There is a likelihood of both an increase in number and variety of diseases and parasites encouraged by the warmer winters and a longer period of disease activity. Change in farming practice may be needed to prevent the increasing risk of heat stress among livestock. Lambing and calving patterns may alter too as a result of the reduced seasonality. With wetter autumns, feeding and bedding costs may be affected as the periods in which animals are housed may increase. Longer growing seasons with reduced frost risk should have several benefits to farmers in general; these factors coupled with the fertilising effect from higher atmospheric CO₂ levels could mean increases to grass production. Up to a 10% to 20% improvement based on current soil nitrogen levels in an average year 2025 – 2035 has been suggested.¹³

Arable, Vegetable, Horticulture and Glasshouse Production

The increase in CO₂ levels may have an effect upon many plant and tree species, however the extent of which is difficult to generalise and could be minimal.¹⁴ Farmers may benefit from an extended growing season, keeping crops in the ground for longer, while others may harvest crops earlier as they reach maturity sooner.

With growing conditions changing for existing crop choices, possibly becoming 'sub-optimal' for some, and with the environmental conditions altering to allow alien pests and diseases, new challenges will exist. Reports are already published suggesting the need to keep up with some effects, such as tan spot and black stem rust, as well as established rust diseases⁷, while possible changes could occur in the range and effect of such diseases as potato blight and Fusarium.

With possible reductions in summer rainfall and changes to the rate of evapotranspiration, there are likely to be impacts upon the moisture levels within soils. Average soil moisture in summer will decrease by reductions of 20% to 50% in SE England by the 2080s^{7,8,9}. Each degree of annual warming is expected to lengthen the growing season by about three weeks in this part of England.

Warmer winters may result in problems with reduced vernalisation. This is the process of exposure to prolonged lower temperatures in winter needed by many plants including some cereals and fruit trees to initiate flowering or break dormancy prior to flowering.

Forestry

Beech and Oak are known to be less suited to a climate with higher temperatures⁸ than Sycamore and Chestnut.

Fishing

The changes to sea temperatures will undoubtedly have an effect on this industry in the future. Studies are showing that fish stocks are already moving towards the poles as oceans warm.^{15,16} There can be a difficulty in separating the current effects of climate change from pressure on fish stocks from pollution and fishing activity. However what can be predicted is that as the concentration of carbon dioxide in the atmosphere increases so the oceans will become more acidic. This will in turn affect the ability of many organisms like shellfish to form their carbonate shells.¹¹ Research shows that in the last 200 years, ocean acidity has increased by 30%, a rate much faster than anytime in the last 65 million years¹². Again this will affect local crab, lobster and shellfish fishermen.

Section 8. Climate Change and Biodiversity

It is widely accepted that climate change is the greatest long-term threat to wildlife, landscapes and habitats on the Isle of Wight and elsewhere^{1,2,3,4}.

Habitats

A number of species and habitat types will be affected by the temperature increases with some following their preferred climatic conditions north, leading to the loss of those for which the Island is the southern limit of their range.

The rising sea levels will threaten coastal habitats such as salt marsh and estuaries; the Island is host to wetlands of importance on a National and European scale. Our limited freshwater wetlands could be lost if sea defences fail and salt water encroaches; this is a threat to our only RSPB reserve at Brading. Loss of freshwater from depleted river flows will threaten our wetland reserves such as Alverstone Mead SSSI. River flooding will impact a range of habitats, some potentially for better, some for worse. The decrease in summer rainfall, resulting in low or no river flow will have serious water quality ramifications. Greater amounts of heavy rainfall during the summer period could increase pollutants, including sewage, discharged into rivers. High temperatures and low flows could cause a dramatic reduction in oxygen levels, threatening the lives of creatures in the rivers. Warmth along with increased pollutant levels could lead to algal blooms, which again would affect water wildlife and be dangerous to human health¹⁷.



The River Medina – serious implications if banks are breached
© Footprint Trust 2006.

Warmer and drier summers will result in more frequent and prolonged drought conditions threatening our grassland and heathland areas. The droughts could be exacerbated by the expected heatwave conditions.

The Island has cliffs of national importance; particularly vulnerable to the effects of climate change are the soft cliffs and Chines on the western coasts. Rising sea level and increased storm surges threaten to increase the rate of erosion to a level where the cliffs can no longer support the complex populations currently present. In addition the reduced level of river flow may cease the erosion necessary at the heads of the Chines required to maintain these features and the rare mix of species they support.

Flora

Changes in seasonality could have serious implications for our plant species, for example changes in leaf growth and the timing of frosts and cold spells could result in the loss of species such as Bluebell and Primrose. Non-natives may begin to thrive on the Island, both beneficial and detrimental varieties. Himalayan Balsam and Japanese Knotweed could become even more prolific but so could desirable species such as Walnut and Sweet Chestnut.

The Hazel tree has been recorded flowering as early as November, and as this trend continues there will be disruption to other wildlife that depends upon it such as dormice and red squirrels. Observations suggest that spring really is arriving earlier. The results are particularly noticeable for early spring plants, with an extreme example being the Hazel. The first flowering of a particular specimen hazel tree has advanced by 55 days in 3

years, (from 21 January 2002 to 26 November 2004) – a staggering 18 days a year. This is almost certainly caused by warmer temperatures in late winter and early spring¹¹

Fauna

Warmer winters may benefit some species' survival but this could include harmful pests and pathogens which are normally weakened or killed by the winter cold. Warmer winters could cause hibernating animals to wake



The iconic Red Squirrel could be lost to the Island (Image thehutch)

early, expending vital energy which should be reserved for the spring. As the climate zones for habitat types migrate north we may lose some of our species; the Red Squirrel may no longer thrive on the Island by the end of the century, preferring the habitats further north where it will be in direct competition for resources with grey squirrels. The Island may lose many of its overwintering birds as they choose locations further north to settle; it is estimated that the potential distribution for the average bird species will shrink by 20% and shift 550km north⁴⁰. The warmer summers could increase the number of insects thus benefiting bats and some birds. An increase in frequency and severity of storms may threaten nests of birds, and flooding may destroy the homes of ground-dwelling wildlife.

Because of its southerly location the Island may be one of the first places in the British Isles to be affected by some of these developments. The biodiversity and landscapes of the Isle of Wight are the features that attract the visitors to our Island. Many of the species under threat are beneficial, or at least, not harmful to agricultural and tourism interests. However, some new opportunities will also arise, and careful planning will help reduce the negative impact that the inevitable changes will bring.⁷

Section 9. Climate Change and Water

Water Supply

By 2025, surface water supplies at the Eastern Yar are predicted by Southern Water to have 17% less water available at peak demand. Abstraction is reduced on the Island most years as there is not sufficient water flow. There is going to be less groundwater available but this source will be relied upon more frequently to augment surface water in the summer.

Modelling of river flows and groundwater sources to predict climate change impacts on direct abstraction has not been carried out on the Island. Environment Agency models tell us that abstraction from the chalk aquifers at current levels can already exceed recharge and two dry years could have a devastating effect on water available³. The other factor is the unknown effect of heavier deluges of rain in winter months. This may mean that more water runs off, instead of being absorbed into the ground and the aquifers⁴.

Rainfall on the Isle of Wight is predicted to decrease by 8% in the summer and increase by 8% in the winter⁵. To this end, and due to current limits on water supplies, Isle of Wight farmers have begun to construct winter storage reservoirs to supplement summer supplies. But these reservoirs will be reliant on wet winters and may need to store two years' water as further abstraction from rivers may not be possible, even in the winter, due to habitat protection⁶ requirements of priority nature conservation sites within the same catchment.

Aquifer levels can also be threatened by saline intrusion and rising sea levels but the Environment Agency do not consider the Island's groundwater sources to be at risk; research is due to be carried out across this area in 2010⁷.

Climate change impacts on demand

Public water supply

Domestic demand is due to increase by 1.45% in the 2020s (assuming medium high emissions scenario and conventional economic development). Non-household demand is predicted to increase by an average of 2.7% under the same conditions.¹

Total Isle of Wight household consumption is 16.37MI/d⁸. A 1.45% increase in demand would require an extra 237,000 litres per day. Total Isle of Wight non-household consumption is 8.91MI/d⁸. A 2.7% increase would require an extra 240,570 litres per day.

This increase in demand has been included in Southern Water's plan but is a considerable pressure on a supply demand balance that could already be viewed as unsustainable.

Increased demand and reduced water supply issues will be exacerbated by a scheme to be implemented by 2020 to protect the River Itchen. This will result in a 50% reduction in water extraction of an area including the River Test, where the Island currently gets 25% of its water via the Cross Solent Main.

Direct abstraction

Under the medium high scenario for the 2020s, the Climate Change Demand for Water report¹⁰ predicts an increase in demand for water directly abstracted for industry and commerce of between 2.4 and 2.8% in the Southern area (in which the Isle of Wight is included). This will have a worst case impact on water demanded by industry on the Island of an additional 5.7MI required per annum (95% of which will be returned to water courses).

The medium high scenario for water abstracted for spray irrigation shows a 16% increase in demand¹⁰. If applicable to all agricultural abstraction, demand will increase by 57.2 MI per annum.

Infrastructure

Sewerage on the Isle of Wight is operated by Southern Water. It is designed to include rainfall events and, using Defra's guidance on climate change, assumes a 20% increase in each rainfall event¹¹. The risk is that extreme rainfall events may cause local flooding if existing pipe work doesn't have enough capacity (development of designs will be ongoing with new climate projections).

Water UK has predicted that 'pipe systems for drinking water supply and sewerage will be more prone to cracking as climate changes lead to greater soil movement [due to] wetting and drying cycles'¹². The design of the sewers already allows for some movement and takes into account different soil types, including clay soil, such as is found on the Isle of Wight and which has 'shrink-swell potential'¹¹.

Water UK also predicts that 'assets on the coast or in flood plains (that covers most of them – networks, water and wastewater treatment works, pumping stations) will be at increased risk from flooding, storm damage, coastal erosion and rises in sea levels'.¹²

Water Quality

Soil erosion resulting from increased runoff from heavy winter rainfall¹³ may settle in waterways (siltation). During the summer there will be less volume available in watercourses to dilute the output from waste water plant. This could mean further treatment with higher carbon and financial costs. Southern Water predicts that its 'greenhouse gas emissions will increase by over 47 ktCO₂e/year as a result of environmental improvements during the next five years'¹¹.

Regional studies revealing 'an increase in river water temperature over the last 20-30 years'¹⁶ suggest that 'increases in river water temperature will be more noticeable in the South and East of the UK'¹⁶. Water UK also report that 'colour and odour problems will result from higher temperatures and more intense rainfall events'.¹²

Section 10. References and Further Reading

N.B. References below are from the full report, therefore not all references are cited in the text. They are all listed in this summary for your information.

Section 1. Climate Change and Extreme Weather Events on the Isle of Wight

1. UK Climate Impacts Programme - <http://ukcp09.defra.gov.uk/>
2. UK Climate Projections 2009 - <http://ukclimateprojections.defra.gov.uk/>
3. Met Office - <http://www.metoffice.gov.uk/climatechange/guide/effects/housing.html>
4. Proudman Oceanographic Laboratory - <http://www.pol.ac.uk/>
5. IPCC - <http://www.ipcc.ch/index.htm>
6. A Paper May 2007 - <http://www3.hants.gov.uk/ea-2.pdf>
7. Hampshire CC Climate Change commission - <http://www3.hants.gov.uk/climatechange/climatechangecommissionof/climate-change-commission1.htm>
8. Hants & IW Local Resilience Forum - <http://www.hiow-localresilienceforum.org.uk/>
9. Community Risk Register - http://www.hiow-localresilienceforum.org.uk/hiow_lrf_community_risk_register
10. National Risk Register - http://www.cabinetoffice.gov.uk/reports/national_risk_register.aspx
11. Pitt Review - http://archive.cabinetoffice.gov.uk/pittreview/thepittreview/final_report.html
12. IW Strategic Flood Risk Assessment 2007 - http://www.iwight.com/living_here/planning/images/SFRA.pdf
13. The Stern Report

Section 2. Climate Change and Health

1. WHO website September 2009. <http://www.who.int/globalchange/climate/en>
2. Isle of Wight Public Health Annual Report. NHS-Isle of Wight & Isle of Wight Council 2009.
3. Health Effects of Climate Change in the UK 2008 - An update of the Department of Health report 2001/2002. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_082836.pdf
4. Climate Change and its Health Implications. A summary report for environmental health practitioners on the health implications of climate change. Issue 1 version 2. November 2008. Chartered Institute of Environmental Health Dr Rosalind Stanwell-Smith. http://www.cieh.org/uploadedFiles/Core/Policy/Publications_and_information_services/Policy_publications/Publications/Climate_Change_health%20implications.pdf
5. Floods, health and climate change: A strategic review. Tyndall Centre Working Paper No. 63. Roger Few, Mike Ahern, Franziska Matthies and Sari Kovats. Tyndall Centre for Climate Change Research. November 2004. <http://www.tyndall.ac.uk/sites/default/files/wp63.pdf>
6. Wakefield District Council website 2009. <http://www.wakefield.gov.uk/Environment/EnergyAdvice/AffordableWarmth/FuelPovertyandHealth.htm>
7. <http://www.statistics.gov.uk/cci/nugget.asp?id=574>
8. http://www.ageconcern.org.uk/AgeConcern/ftf_winter_deaths.asp
9. Isle of Wight Fuel Poverty Strategy. Isle of Wight Council. December 2006.
10. Excess Winter Deaths and Fuel Poverty. Help the Aged. London. 2007.)
11. Mortality in southern England during the 2003 heat wave by place of death. Report from Office of National Statistics. July 2006. <http://www.statistics.gov.uk/articles/hsq/1419.pdf>
12. Mortality in 13 French Cities During the August 2003 Heat Wave. American Journal of Public Health September 2004 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1448485/>
13. Heatwave: supporting vulnerable people before and during a heatwave: advice for care home managers and staff. Department of Health. Crown. 2009. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_084718
14. Climate change and human health. World Health Organisation website. <http://www.who.int/globalchange/en/>
15. Protecting health from climate change: Global research priorities. WHO. 2009. <http://www.who.int/globalchange/publications/9789241598187/en/index.html>
16. Institute of Cancer Research July 2007.
17. Health Effects of Climate Change in the UK. Expert Group on Climate Change on Health in the UK. Dept of Health 2001, updated 2008.
18. Health Effects of Climate Change in the UK. Expert Group on Climate Change and Health in the UK. Department of Health. 2001. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4007935
19. Sustainable Farming and Food Strategy – indicator data sheet Social outcome: Public health in particular through improved nutrition and workplace health and safety Core indicator 7.03: Foodborne illness. 2009. <https://statistics.defra.gov.uk/esg/indicators/pdf/c703.pdf>
20. Climate change and the incidence of food poisoning in England and Wales. Graham Bentham • Ian H. Langford. Int J Biometeorol (1995) 39:81-86 <http://www.springerlink.com/content/r880728537573677/fulltext.pdf>
21. Health Effects of Climate Change in the UK (draft for comments): An update of the Department of Health Report 2001/2002". Department of Health, 2007. Available from http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_074439

22. Climate Change and its Health Implications. A summary report for environmental health practitioners on the health implications of climate change Issue 1: Version 2 November 2008

Further Reading

Department of Health report - Health Effects of Climate Change in the UK 2002, updated 2007
http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4007935
World Health Organisation, Environment & Health News http://www.euro.who.int/envhealth/20060510_1

Section 3. Climate Change and Delivery of Public Services

1. Energy Saving Trust website under the Nottingham Declaration- <http://www.energysavingtrust.org.uk/nottingham/Nottingham-Declaration/Local-Services>

This is a good source of further reading and has many ideas for mitigation and adaptation of local services.

2. National Risk Register - http://www.cabinetoffice.gov.uk/reports/national_risk_register.aspx

Particularly see the sections on “Natural Events” and “Considerations for Organisations”

Section 4. Climate Change and Infrastructure

1. Isle of Wight Strategic Flood Risk Assessment. Isle of Wight Council November 2007. © Entec UK Limited 2007)

2. Chapter One Coastal Evolution, Behaviour and Climate Change. © Centre for the Coastal Environment, Isle of Wight Council, September 2006. <http://www.coastalwight.gov.uk/response/index.htm>

3. www.coastalwight.gov.uk/smp/projects.htm

4. http://www.meto.gov.uk/education/teens/casestudy_great_storm.html

5. National Risk Register, Chapter 2.

www.cabinetoffice.gov.uk/media/cabinetoffice/corp/assets/publications/reports/national_risk_register/national_risk_register_risks.pdf

6. Isle of Wight Public Health Annual Report. NHS-Isle of Wight & Isle of Wight Council 2009.

7. <http://www.clarke-energy.co.uk/case-studies/case%20study%20Wight%20Salads.pdf>

8. <http://www.europeanislands.net/?secid=2&pid=26&>

9. www.npower.com/rwenpowercr/docs/cowes/dl-site-info.pdf

10. National Risk Register, Chapter 2.

http://www.cabinetoffice.gov.uk/media/cabinetoffice/corp/assets/publications/reports/national_risk_register/national_risk_register_risks.pdf

11. <http://news.bbc.co.uk/1/low/uk/2373523.stm>

12. www.og.decc.gov.uk/downstream/emergencies/down_emerge.htm

13. www.rssb.co.uk/pdf/infobul_issue102.pdf

Network Rail Strategic Business Plan October 2007

14. www.networkrail.co.uk/browse%20documents/StrategicBusinessPlan/The%20Strategic%20Business%20Plan.pdf

15. Lancet 16 May 2009

16. Effects of Climate Change on Fire and Rescue Services in the UK. Fire Research Technical Report 1/2006. December 2006. Department for Communities and Local Government: London.

Further Reading

Beating the heat: Keeping UK buildings cool in a warming climate
http://www.ukcip.org.uk/images/stories/Pub_pdfs/Beating_the_heat.pdf

Section 5. Climate Change and Business Continuity

1. National Risk Register - http://www.cabinetoffice.gov.uk/reports/national_risk_register.aspx

Particularly see the sections on “Natural Events” and “Considerations for Organisations”

Further Reading

Business Link – “Adapt your business to the effects of climate change” -
<http://www.businesslink.gov.uk/bdotg/action/layer?r.s=tl&r.l1=1079068363&r.lc=en&r.l2=1079363464&topicId=1081658406>

UKCIP (UK Climate Impacts Programme) - Adaptation Wizard – “to help you to assess your vulnerability to current climate and future climate change” http://www.ukcip.org.uk/index.php?Itemid=273&id=147&option=com_content&task=view

UKCIP – Business Planning for the Impacts of Climate Change

http://www.ukcip.org.uk/images/stories/Pub_pdfs/Georgette.pdf

CLARA (Climate Adaptation Resource for Advisors) – a resource for small and medium enterprises

http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=531&Itemid=498

TUC – Changing Work in a Changing Climate

<http://www.tuc.org.uk/economy/tuc-16331-f0.cfm>

Section 6. Climate Change and Tourism

1. The Changing Climate of Tourism, Dr Jane Strachan of Reading University Dept of Meteorology
2. 1st International Conference on Climate Change and Tourism
3. Halifax Travel Insurance Holiday 2030 report

Section 7. Climate Change and Agriculture

1. www.farmingfutures.org.uk
2. http://www.iwight.com/living_here/planning/images/SFRA.pdf and http://www.iwight.com/living_here/planning/images/SFRAAppendixA.pdf
3. Baker .C,John, Saxton .Keith,E, Reicosky D.C. et al No-tillage Seeding in Conservation Agriculture 2nd Edition (Food and Agriculture Organization of the United Nations, 2006)
4. <http://www.sowap.org/results/soilandwater.htm>
5. <http://www.defra.gov.uk/foodfarm/farmanimal/welfare/transport/heat.htm>
6. <http://www.food.gov.uk/multimedia/pdfs/redmeatsafety.pdf>
7. <http://www.fwi.co.uk/Articles/2008/03/10/109755/changing-climate-might-change-spray-programmes.html>
8. <http://www.forestresearch.gov.uk/fr/INFD-5ZYJS6>
9. http://www.iow.nhs.uk/uploads/PublicHealth/Report2009/PH_Annual_Report_2009-FINAL-small.pdf
10. [www.iwep.com/Upload/Assets/File/The state of Rural Wight 2008 latest version.pdf](http://www.iwep.com/Upload/Assets/File/The%20state%20of%20Rural%20Wight%202008%20latest%20version.pdf)
11. http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=413&Itemid=455
12. <http://www.mccip.org.uk/default.htm>
13. <http://www.nfuonline.com/documents/Policy%20Services/Environment/Climate%20Change/NFU%20Climate%20Change.pdf>
14. <http://www.newscientist.com/article/dn11655-climate-myths-higher-co2-levels-will-boost-plant-growth-and-food-production.html>
15. http://www.uea.ac.uk/~mhe06qau/alli_files/perry2005.pdf
16. <http://www.sahfos.ac.uk/climate%20encyclopaedia/fisheries.html>
17. Conversation with Mike Pittock, Forestry Commission, 30/10/2009

Further reading

- http://www3.hants.gov.uk/hantscc_woodlands.pdf
[www.foresight.gov.uk/Infectious Diseases/t7_3.pdf](http://www.foresight.gov.uk/Infectious%20Diseases/t7_3.pdf)
<http://www.right-trees.org.uk/>
<http://www.defra.gov.uk/environment/quality/land/soil/documents/soil-strategy.pdf>
<http://www.forestry.gov.uk/>
<http://www.fwi.co.uk/Home/>
http://www.ukia.org/eabooklets/EA_Climate%20Change%20Impacts%20Horticulture_Final.pdf
<http://www.nfuonline.com/documents/Policy%20Services/Environment/Climate%20Change/NFU%20Climate%20Change.pdf>

Section 8. Climate Change and Biodiversity

1. RESPONSE report. Coastal Evolution, Behaviour and Climate Change. © Centre for the Coastal Environment, Isle of Wight Council, September 2006.
2. Responding to the impacts of climate change on the natural environment: Dorset Downs NE116. Natural England 2008.
3. Statement by Royal Society <http://royalsociety.org/page.asp?id=4761>
4. Statement by RSPB www.rspb.org.uk/ourwork/policy/climatechange/northernireland.asp
5. www.hm-treasury.gov.uk/sternreview_index.htm
6. How is climate change affecting England's natural environment?
www.naturalengland.org.uk/ourwork/climateandenergy/climatechange/naturalenvironment/default.aspx
7. The State of Rural Wight. Rural Priorities Group. April 2008.
<http://www.iwep.com/Upload/Assets/File/The%20state%20of%20Rural%20Wight%202008%20latest%20version.pdf>
8. Overview of climate Change on Hampshire and the Isle of Wight. www.shecane.org
9. <http://ukclimateprojections.defra.gov.uk>
10. Isle of Wight Biodiversity Action Plan, Isle of Wight Council.
11. Study by Royal Botanic Garden, Edinburgh. Press release "Does early spring spell the end of Scotland's postcard winters?" March 2005. http://www.rbge.org.uk/assets/files/about_us/press_releases_05/Phenology_Mar_05.doc
12. Royal Horticultural Society website www.rhs.org.uk/climate/advice/trees2.asp
13. Woodlands. Rackham, R. Harper Collins. London. 2006
14. <http://www.energysavingtrust.org.uk/nottingham/Nottingham-Declaration/Local-Services/Environment/Biodiversity>
15. Landslides and Climate Change – Challenges and Solutions. R.McInnes et al. Centre for the coastal Environment, Isle of Wight Council, UK. Taylor & Francis. London UK. 2007.
16. "The Climate is Changing – Time to Get ready. Environment Agency March 2005
http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/documents/digitalasset/dg_073021.pdf
17. Summary of the first ever Thames Basin Vulnerability Report. Published by WWF-UK. July 2008.
www.wwf.org.uk/filelibrary/pdf/thames_vulnerability.pdf

18. Freshwater Fish of the British Isles. Giles, N. Swann Hill Press. Shewsbury. 1994.
19. 'Dragonfly should be climate change indicator' Daily Telegraph 11 Jan 2008
20. www.dragonflysoc.org.uk
21. United Nations Environment Programme World Conservation Monitoring Centre <http://www.unep-wcmc.org/species/dbases/about.cfm>
22. www.butterfly-conservation.org
23. Landslides and Climate Change – Challenges and Solutions. R.McInnes et al. Centre for the coastal Environment, Isle of Wight Council, UK. Taylor & Francis. London UK. 2007.
24. MONARCH (Modeling Natural Resource Responses to Climate Change - Executive Summary - a synthesis for biodiversity conservation 2007. http://randd.defra.gov.uk/Document.aspx?Document=WC02015_5348_EXE.pdf
25. Climate change threatening bird species, RSPB says. Guardian 15 January 2008. www.guardian.co.uk/environment/2008/jan/15/conservation.endangeredspecies
26. http://www.bbc.co.uk/wales/nature/sites/naturediary/pages/climate_bats.shtml 27. Bat Conservation Trust <http://www.bats.org.uk>
28. www.rspb.org.uk
29. <http://www.bto.org>
30. Fish that triggers hallucinations found off British coast. Daily Telegraph, London 13 May 2009.
31. The United Kingdom Marine Climate Change Impacts Partnership website <http://www.mccip.org.uk/elr/non-natives/default.htm>
32. Fishing, climate change and north-east Atlantic cod stocks by Nova Mieszkowska, David Sims and Steve Hawkins. May 2007. Marine Biological Association of the UK, Plymouth. www.wwf.org.uk/filelibrary/pdf/cc_cod_report.pdf
33. <http://www.defra.gov.uk/environment/marine/documents/science/stateofsea/chartprogress-4.pdf>. (Immigration of southern fish species to south-west England linked to warming of the North Atlantic (1960–2001) A.R.D. Stebbing Journal of the Marine Biological Association of the UK (2002), 82:2:177-180 Cambridge University Press. Copyright © 2002 Marine Biological Association of the United Kingdom.
34. Impacts of Climate Change on Harmful Algal Blooms. Prof Gustaaf Hallegraeff. University of Tasmania. www.scitopics.com/Impacts_of_Climate_Change_on_Harmful_Algal_Blooms.html
35. <http://news.bbc.co.uk/1/hi/england/cornwall/8200387.stm>
36. The Dormouse Monitor. PTES. London. Summer 2004.
37. Climate could kill Wales red kite. Statement by WWF. NewsWales. 14 November 2006. <http://www.newswales.co.uk/?section=Environment&F=1&id=9917>
38. Hampshire and Isle of Wight Wildlife Trust website, 'Water for Wildlife' accessed on 12th October 2009 URL: <http://www.hwt.org.uk/pages/invertebrates.html>
39. Effects of Climate Change on Fire and Rescue Services in the UK. Fire Research Technical Report 1/2006. December 2006. Department for Communities and Local Government: London.
40. The Climatic Atlas of European Breeding Birds

Further reading

MONARCH: Modelling Natural Resource Responses to Climate change. "The MONARCH 3 synthesis report is the result of a seven-year partnership programme, involving 15 partner organisations across Britain and Ireland, including governmental agencies and NGOs and a research team led by the Environmental Change Institute, University of Oxford. The final phase of the MONARCH programme studied the projected change in suitable climate for 120 rare or threatened species that are currently being conserved through the UK Biodiversity Action Plan. Thirty-two of these were explored in detail and it was found that a majority are likely to be affected by climate change." http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=331
<http://www.naturescalendar.org.uk/> - thousands of volunteers record the signs of the seasons

Section 9. Climate Change and Water

1. Southern Water (2009) Water Resources Management Plan 2010-2035
2. Environment Agency (2004) The Isle of Wight Catchment Abstraction Management Strategy. Downloaded from www.environment_agency.gov.uk on 12th Jan 2009 URL: <http://publications.environment-agency.gov.uk/pdf/GESO0304BNMS-e-e.pdf>
3. Environment Agency (2009) Isle of Wight Upper Greensand/Lower chalk study – Executive summary emailed from Alison Matthew, EA to Leah Rumble on 23rd Oct 2009.
4. Holman, I.P. (2006) Hydrogeology Journal 14(5), 637-647. 'Climate change impacts on groundwater recharge – uncertainty, shortcomings and the way forward?' Downloaded from the Cranfield CERES website <https://dspace.lib.cranfield.ac.uk/> on 11th October 2009 URL: <http://hdl.handle.net/1826/1940>
5. UK Climate Projections 2009
6. Email from Rod Murchie, Environment Agency to Leah Rumble, 9th October 2009
7. Email from Rod Murchie, Environment Agency to Leah Rumble, September 2009
8. June 2009 Returns from Southern Water to EA, emailed from Meyrick Gough, Southern Water to Leah Rumble, July 2009
9. Email from Rob Bouttle, Environment Agency to Leah Rumble, 15th July 2009
10. Downing, T.E., Butterfield, R.E., Edmonds, B., Knox, J.W., Moss, S., Piper, B.S. and Weatherhead, E.K. (and the CCDeW project team) (2003). Climate Change and the Demand for Water, Research Report, Stockholm Environment Institute Oxford Office, Oxford. URL <http://hdl.handle.net/1826/3576>
11. Email from Paul Kent of Southern Water to Leah Rumble, 14th October 2009.
12. Water UK (2008) 'How the water industry is adapting to climate change' Water UK briefing downloaded from website www.water.org.uk on 14th September 2009. URL: <http://www.water.org.uk/home/policy/climate-change/adaptation-briefing#impacts>

13. Dessler, A. and Parson, E.A. (2006). The Science and Politics of Global Climate Change. Cambridge: Cambridge University Press.
14. Hill, P et al. School of Agriculture, Purdue University website, 'Conservation Tillage and Water Quality', accessed 11th October 2009. URL: <http://www.ces.purdue.edu/extmedia/WQ/WQ-20.html>
15. Hampshire and Isle of Wight Wildlife Trust website, 'Water for Wildlife' accessed on 12th October 2009 URL: <http://www.hwt.org.uk/pages/invertebrates.html>
16. Hammond, D & Pryce, A.R.(2007) 'Climate change impacts and water temperature' Bristol: Environment Agency Science Programme

General Reading

UK Climate Projections 09 – <http://ukcp09.defra.gov.uk/> and its Technical Site which has pre-prepared maps & graphs and a User Interface which lets you produce specific predictions - <http://ukclimateprojections.defra.gov.uk/> - enter via the User Interface or Customisable outputs. It gives climate change projections for temperature, precipitation, air pressure, cloud and humidity, for 7 different time periods, and for low, medium & high emissions. It does this for large areas and also for 25km grid squares (one of them (1741) covers most of the IW). It can produce Plume Plots (possibly the easiest to understand) along with Cumulative Distribution Curves, Joint probability Plots, or Probability Distribution Curves. NB The projections are given as averages over 30 year periods, not year by year variations.

The UK Climate Impacts Programme (UKCIP) helps organisations to adapt to inevitable climate change. While it's essential to reduce future greenhouse gas emissions, the effects of past emissions will continue to be felt for decades. The website has a wealth of information, case studies and tools.

The Environment Agency (EA) aims to be at the forefront of the climate change adaptation agenda in the UK.
<http://www.environment-agency.gov.uk>

Met Office <http://www.metoffice.gov.uk/climatechange/>

Climate South East – in which the IW Council is a partner <http://www.climatesoutheast.org.uk/index.php>

The Rough Guide to Climate Change – Robert Henson

Intergovernmental Panel on Climate Change (IPCC) 2007 <http://www.ipcc.ch/index.htm> – a very generalised world-wide report, which is quite technical. It is felt by some that their predictions are already conservative and a bit timid.

The Adaptation Wizard on UKCIP - http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=147&Itemid=273

Nottingham Declaration Action Pack (NDAP) for Council services - <http://www.energysavingtrust.org.uk/nottingham/Nottingham-Declaration/Local-Services>