

## RGS-IBG KS3 Tutorial – Climate Change – Students' Booklet

**Introduction:** Climate change is often written about in newspapers and featured on the television. The earth's climate has changed many times in the past but more recently scientists believe that the actions of humans are having a bigger impact on the changes to the planet's climate.

This impact is very great and could lead to the extinction of many forms of life on the planet. In 1988 the **IPCC** was created (International Panel on Climate Change) to measure climate changes on the planet which are caused by human action.

Climate change research is being carried out urgently and there are many theories and uncertainties about the findings. There are, however, certain facts that are largely agreed on. These facts are explained below.

Also, climate change has become a political issue as there are many who stand to win and lose as laws and public opinion changes. Whilst there are many facts about climate change, there is also a number of mistruths in the media. The public and particularly students, therefore, need to be careful in checking the source of information at which they are looking and keeping in mind that very often misleading information can be very convincing.

### What do climatologists generally agree on?

- Global temperatures have increased for many reasons, but in the industrial age, climate change has been increasing at an increasing rate. The planet warmed by 0.5°C in the 20<sup>th</sup> Century.
- Most of the warmest years ever recorded were in the 1990s with the decade being the warmest decade of the last millennium.
- Average global sea levels have increased by between 10 and 20 cm over the last 100 years. This has been due to polar ice melting and increased rainfall.
- There has been an increase in the frequency of extreme weather events including both storms and droughts.
- The IPCC acknowledges the link between human use of natural resources and the climatic change the planet is experiencing.

## What are the impacts?

The IPCC<sup>1</sup> identifies four serious potential impacts of climate change:

- increased threats to human health, particularly in lower income populations;
- increased extinction risk for some vulnerable species; decreased agricultural yield in many tropical and subtropical regions;
- heightened water shortages in many water-scarce areas of the world;
- further risk of storm and flooding damage in populations that inhabit small islands and low-lying coastal areas.

## What has this got to do with geography?

Geography is the study of the relationships between the earth and those who live on it. Understanding climate change is an important aspect of understanding the place of humans on the planet and is an important part of developing ways of dealing with challenges facing the human population as well as the natural world within which they live.

The impacts of climate change will affect different places in different ways and geographers are well trained to deal with the relationships between problems and solutions.

## The science of climate change

The IPCC<sup>2</sup> has outlined the principal facts relating to the science of climate change. They note that increases in greenhouse gas concentrations *have* led to a positive impact on climate, warming the earth's surface and leading to other climatic impacts. Many greenhouse gases remain in the atmosphere for a long time and their impact accumulates over time.

According to the IPCC night time temperatures have increased more than daytime temperatures and there have been some extreme weather events which have been the result of unusual phenomena. The IPCC calls for more research to be done to be more certain about changes in climate.

The IPCC also says that whilst it can be difficult to tell what climate change is natural and what is attributable to humans. However, it is clear that warming trends are unlikely to be entirely natural. Scientists are cautious in implying too much from limited data, but the IPCC states that the 'balance of evidence suggests that there is a discernible human influence on global climate.'

There is sufficient evidence from the information available about climate change to confidently predict a big change in temperatures by 2100 and further increases in sea levels caused by the melting of glaciers and ice sheets as well as the thermal expansion of the ocean due to increased

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<sup>1</sup> Watson RT, and Core Writing Team (eds), (2001). Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

<sup>2</sup> <http://www.ipcc.ch/pub/sarsum1.htm>

temperatures. The predictions also include the reduction in strength of the North Atlantic Drift (NAD) which springs from the Gulf Stream. It is also expected that warmer temperatures will lead to stronger droughts and floods due to bigger storms and tropical cyclones. It is also suggested that rapid climate change could change the balance between the species and that if forests die back there could even be more carbon dioxide in the atmosphere. The IPCC is quick to point out that the rate of change is still uncertain. In some instances some processes may occur more quickly than expected or more slowly, sometime suddenly, or even not at all.

### **Places and Circumstances**

The impact of climate change on human activity is very significant. In some places the brunt of this change is already being felt and local communities are having to make serious adaptations.

#### >> Farming in Australia

Projections from the CSIRO<sup>3</sup>, The Commonwealth Scientific and Industrial Research Organisation (Australia) have indicated that along the Murray Darling river basin by 2007 there could well be significant changes in temperature that would significantly affect the discharge of the river, and indeed the sustainability of various kinds of agriculture along its course.

#### >> Coral bleaching

Research by the Bureau of Oceans and International Environmental and Scientific Affairs in the USA have indicated that there continues to be a grave threat to complex coral reef communities due to climatic changes that would continue the trend of reef bleaching and the death of reef beds. Moreover, there are significant implications here for tourism, fisheries, storm mitigation and medicine.

#### >> Potential evacuation of low lying islands in Tuvalu

Tuvalu is a small island state in the south Pacific. Its low lying land and small area make it susceptible to sea level rise. It is anticipated that with sea levels increasing, Tuvalu might well be uninhabitable in the next 50-100 years. The South Pacific Applied Geoscience Commission suggests that whilst there may be a range of challenges facing Tuvalu, the country is increasingly vulnerable to environmental disaster. Some suggestions have been made that the population of the country may need to be wholly relocated, although the Prime Minister did not regard this as an imminent problem.

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<sup>3</sup> <http://www.csiro.au/science/ps1f2.html>

### >> Massive species extinctions predicted

There is evidence to suggest that climate change may be devastating to biodiversity leading to the extinction of large proportions of regional species. Recent studies published in Nature<sup>4</sup> magazine suggest that in some areas of the world as many as 37% of species may be made extinct. Naturally, this would not only have an impact on the biodiversity of a given region, but also its ecosystem and food chain. Such events could have even more severe, and unanticipated consequences for the planet.

### >> Extinction of the Polar Bear

The polar bear population is under threat from climate change. It is argued that the rapid climatic changes afoot in the Arctic regions is leading to changing oceanic and atmospheric circulation patterns. Ice thinning has meant that there has been much less ice on which bears may rest whilst hunting for seals. This is leading to them having less time to hunt. Correspondingly bears are becoming thinner and are less well equipped in terms of body weight to hibernate and to have young.

### >> Billions face serious risks due to water shortages

The IPCC<sup>5</sup> has indicated that as many as 250 million people across Africa could be short of water by 2020 and that crop yields might decline by up to 30% in Central and South East Asia by 2020. It also suggested that agriculture may decline in Africa by 50% where it was dependent on rainfall.

## Responses to Climate Change

Climate change is becoming more important politically as people become more knowledgeable. Governments have been investing money into research that is improving the awareness and understanding of climate change. The Stern Review<sup>6</sup> written by Nicholas Stern for the British government was published in 2006 and outlines the current state of research and the implications of climate change on the world economy. It calls for an urgent and significant investment if the implications of climate change are to be averted. With this document and the impact of other high profile summaries such as Al Gore's *An Inconvenient Truth*, there has been much more awareness. Environmental issues have been on the political stage more and more with world leaders making detailed plans to grapple with the issues both locally and internationally.

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<sup>4</sup> Thomas, C. et al (2004) Extinction Risk from Climate Change, Nature 427, 145-148.

<sup>5</sup> [http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/06\\_04\\_05\\_climate.pdf](http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/06_04_05_climate.pdf)

<sup>6</sup> [http://www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/stern\\_review\\_report.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm)

## Glossary

**Greenhouse emissions:** Greenhouse emissions are gases that are released into the atmosphere by naturally or man-made means. Human related emissions result from the burning of fossil fuels and the reduction in natural systems that can process carbon dioxide as happens with deforestation. Also some farming practices release increased amounts of methane, and industrial refrigerants can also release greenhouse gases into the atmosphere.

**IPCC:** The IPCC is the Intergovernmental Panel on Climate Change and was established in 1988 by two organisations of the United Nations, the World Meteorological Society (WMO) and the United Nations Environmental Programme (UNEP). The organisation was established to evaluate the risks associated with changing climate, insofar as it was being influenced by human action.

**NAD:** The North Atlantic Drift is part of an oceanic current that moves warm water north from the Gulf of Mexico into the northern reaches of the North Sea. The bigger current of which this is a part is called the Gulf Stream. As this water moves further north, its warmth is transferred to the atmosphere, and as it cools its density increases and the water sinks forming a 'conveyor belt,' of water drawing back southwards at depth.

**Gulf Stream:** See NAD North Atlantic Drift.

**CSIRO:** The Commonwealth Scientific and Industrial Research Organisation is an Australian government body for science research.

**Stern Review:** This is a report that was written by Nicholas Stern for the British government looking at the effect of climate change on the world economy. It was published in October, 2006.