

## Climate Change: The Facts

Adapted from an article published in *The Guardian* newspaper supplement — Science Course Part III: The Earth (in association with the Science Museum)

The subject of global warming has become impossible to ignore. But what are its implications? And is mankind really to blame?

Twenty years ago global warming was a fringe subject — it seemed absurd that we could be having an effect on the Earth's climate. Today global warming has become a political hot potato and the majority of scientists agree that it is a reality and here to stay.

### What is global warming?

Extra carbon dioxide [CO<sub>2</sub>] in the atmosphere enhances a natural process known as the greenhouse effect. Greenhouse gases, such as carbon dioxide, absorb heat and release it slowly. Without this process, Earth would be too cold for life to survive.

Over the past 200 years mankind has increased the proportion of greenhouse gases in the Earth's atmosphere, primarily by burning fossil fuels. The higher levels of greenhouse gases are causing our planet to warm — global warming.

### Is global warming really caused by humans?

Since 1958 scientists at the Mauna Loa Observatory in Hawaii have taken continuous measurements of atmospheric carbon dioxide. The levels go up and down with the seasons, but overall they demonstrate a relentless rise.

Bubbles of gas from ice cores and the chemical composition of fossil shells provide us with a record of atmospheric carbon dioxide going back millions of years. There have been warm periods in the past where carbon dioxide was at levels similar to those seen today. However, the rate of change that we see today is exceptional: carbon dioxide levels have never risen so fast. By 2000 they were 17% higher than in 1959.

Accompanying this rapid increase in carbon dioxide we see a rise in average global temperatures. Warming in the past 100 years has caused about a 0.8°C increase in global average temperature. Eleven of the 12 years in the period 1995-2006 rank among the top 12 warmest years since 1850.

There is little doubt that humanity is responsible for the rapid rise in carbon dioxide levels. The rise in temperatures that has accompanied our fossil fuel addiction seem too much of a coincidence to be just chance. Most people now agree that our actions are having an effect on Earth's climate.

### How hot will it get?

**Comment [I1]:** Brief and concise 'the facts'. Sounds informal and accessible because it needs to appeal to a non-expert audience of laymen as this is part of an informal 'science course' published in a newspaper. The concision also suggests a blunt, no nonsense approach which is going to tell us the truth and exactly what we need to do — something many people may find helpful given some of the confusing debates about whether global warming is or isn't caused by human behaviour

**Comment [I2]:** It is all around us and it won't be going away — this suggests its importance.

**Comment [I3]:** It wasn't seen as much of a threat as it is today. The issue has become worse.

**Comment [I4]:** Suggests that it is a very serious topic as many politics are also talking about it. It is an ongoing discussion

**Comment [I5]:** Emphasises how it won't just fade out of the news like other topics.

**Comment [I6]:** Short sub headings used to break up the extract. It explains what the next paragraph will be about allowing the reader to find information easily or organise this new information in an easy 'question — answer' format' making the rest of the article more user friendly. Hence it begins with the most basic question — what is global warming — and builds up to more complex ideas

**Comment [I7]:** Extra: suggests too much.

**Comment [I8]:** Easy to understand; some people may not know that carbon dioxide is CO<sub>2</sub>; makes it user friendly because it is not very scientific.

**Comment [I9]:** There is a sense of balance here as the writer makes it clear that it is natural for carbon dioxide to be around us in the atmosphere, it isn't a 'bad'

**Comment [I10]:** It explains how the extra CO<sub>2</sub> is actually the greenhouse effect and not global warming. Explaining the peoples misconception about what global warming actually is.

**Comment [I11]:** Makes sure that the reader understand the difference between greenhouse effect and global warming, by dividing it into two separate paragraphs.

**Comment [I12]:** Show how this is how this is an ongoing issue. It is also a serious issue; emphasised by the idea of scientists still trying to figure some statistics out.

**Comment [I13]:** Persistent rise, but relentless makes the issue of global warming seem more out of control - serious.

**Comment [I14]:** Very easily visualised image to make this accessible for a non-scientific (layman) reader

**Comment [I15]:** Clear explanatory details broken down into short sentences and short paragraphs using simple down to earth language and easily accessible images — like bubbles — to illustrate points in a way that will be easily understandable for the readers

**Comment [LA16]:** 'rate of change' lends the article a sense of scientific credibility as it is more complex than speed, although still relatively easy to understand for most readers. 'Exceptional' emphasises how it's unique; we've never experience something like this before, suggesting that this really is a threat

**Comment [LA17]:** The statistics are easily understood, also show the importance and the danger of the topic.

**Comment [LA18]:** Basic statistics emphasise the dangers of global warming and how rapid the changes are occurring.

**Comment [LA19]:** 'rapid' makes it sound that the CO<sub>2</sub> is coming in vast amounts very quickly, like a flooding river — again an image that would be easily comprehensible for most readers

**Comment [LA20]:** The human addiction to fossil fuels shows how maybe this is our doing. Addiction also creates the impression that this behaviour is harmful and life-threatening but also hard to give up — like an addiction

**Comment [LA21]:** 'Too much of a coincidence' suggests that it isn't something we can ignore; the issue of global warming is really serious. It is also a simple down to earth argument against the sceptics who claim that we can't be sure that we are causing global warming because the temperature might just be going up because of something else. 'Too much of a coincidence' is a commonly used phrase in reasoning and although not strictly scientific (it could actually just be a coincidence) is likely to convince most lay-readers

**Comment [LA22]:** 'Just be chance emphasises this point

Estimates from some of the world's best climate scientists — the Intergovernmental Panel on Climate Change (IPCC) — suggest that the average global temperature will have risen between 2.5C and 10.4C by 2100.

**Comment [LA23]:** Statistics again show the importance of the topic, also seen by the mentioning of the official sounding IPCC – the name of which implies it has a large amount of agreement from across different countries / governments

Whether it will be the lower or upper end of this estimate is unclear. Currently, oceans and trees are helping to mop up some of the heat by absorbing carbon dioxide, but eventually they will reach capacity and be unable to absorb more. At this point the atmosphere will take the full load, potentially pushing temperatures sky high.

**Comment [LA24]:** It seems as if the oceans can remove our waste easily

**Comment [LA25]:** However, the mop will become too full, again an easily accessible image, that means this easy solution to the problem of rising CO2 levels will not work forever

### Is it just carbon dioxide we need to worry about?

No. Carbon dioxide is just one of a number of greenhouse gases, which include water vapour, methane, nitrous oxide and ozone. Livestock farming (farting cows) and rice paddy farming (rotting vegetation) have contributed to higher levels of methane in the atmosphere. What is more, methane has a nasty sting in its tail. Although it only hangs around in the atmosphere for about 10 years, it is far more potent as a greenhouse gas, trapping about 20 times as much heat as carbon dioxide.

**Comment [LA26]:** 'Full load' emphasise how so far this hasn't happened; something we haven't experienced. 'Pushing' shows how the rise in temp. Has been forced on by the excess CO2 from humans.

**Comment [LA27]:** The simple sentence is definite and suggests that there are more problems than just CO2 – again reinforcing the seriousness and complexity of this issue

**Comment [LA28]:** Informal; funny and easily accessible to all readers. Attention grabbing. The comparison to something funny but then the serious issue helps the readers to understand what is going on and makes the article more engaging

**Comment [LA29]:** 10 years here is made to seem very short, but this is undermined by the fact that it is a very powerful greenhouse gas – trapping 20 times as much heat as CO2 ... hence the 'sting' – again an easily understood image

The structure here is one intended to undermine potential sources of relief and thus emphasise how serious the problem is:  
1) the oceans mop up the CO2 . but not forever  
2) is it just CO2 . no, there are many other gases  
3) only 10 years . but 20 times worse than CO2

### What are tipping points?

A steady rise in greenhouse gases won't necessarily cause a steady rise in global temperatures. Earth's climate is highly complicated and scientists fear that many delicate thresholds exist, which once passed could trigger a dramatic change. These thresholds have become known as "tipping points".

**Comment [LA30]:** Delicate suggests easily surpassed or broken emphasising the potential danger and the fragility of the Earth – something it is important for readers to realise as the Earth is often thought of as being too big to be fragile

**Comment [LA31]:** 'Trigger' sounds very sudden which, makes the idea of dramatic change seem even worse as it will affect everyone and not just the reader.

One potential trigger could be the release of methane from methane clathrate compounds buried on the sea floor. Currently these deposits are frozen, but if the oceans warm sufficiently they could melt, burping vast quantities of methane into the atmosphere. Scientists fear that this sudden release may cause a runaway greenhouse effect.

**Comment [LA32]:** Sudden release again emphasises the potential danger

**Comment [LA33]:** Unstoppable, uncontrollable

### How will global warming affect us?

Although average global temperatures are predicted to rise, this doesn't necessarily mean that we'll be sitting in our deckchairs all year round. The extra energy from the added warmth in the Earth's atmosphere will need to find a release, and the result is likely to be more extreme weather.

**Comment [LA34]:** 'Extreme' suggests something dangerous which contrasts with the pleasant deck chair image, again the structure is one of potential relief (won't that just mean that we will get better weather – a likely comment from readers especially those in Britain) which is undermined by the statement that the weather won't be better just more 'extreme' ... this structure seeks to make it clear to the reader that there is no real potential up-side to this problem

### If we stop emitting CO2 now will it get better straight away?

Unfortunately not. Research shows that we are already committed to an average global temperature rise of nearly 1C, lasting for at least the next 500 years.

**Comment [LA35]:** Already committed makes it sound like we are running out of time – re-emphasising the threatening nature of global warming

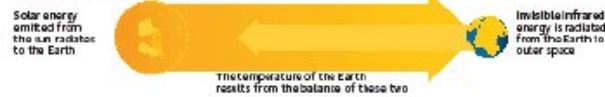
**Comment [LA36]:** 1C if put at the beginning would appear very little however, due to knowing the consequences the issue of 1C is taken more seriously. Furthermore, 500 years shows how it appears to be almost never ending.

Kate Ravilious

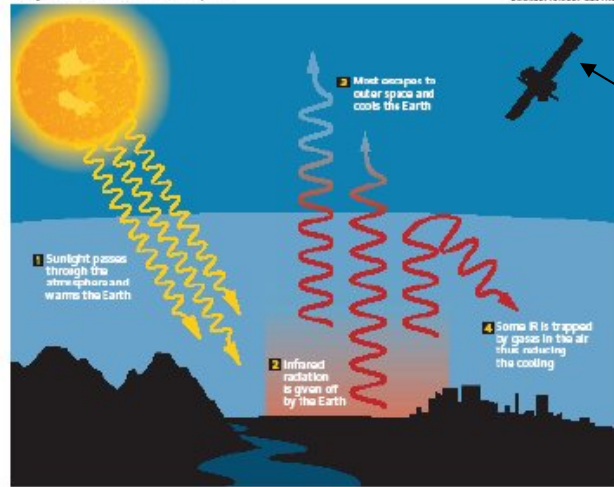
Sub headings showing what the image is for; Easy/simple layout.

### What is global warming?

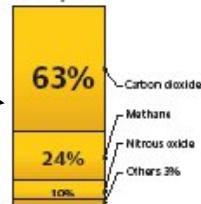
What determines the temperature of the Earth?



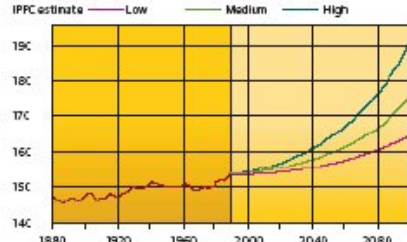
### The greenhouse effect on the atmosphere



CO<sub>2</sub> is the major contributor to global warming  
Current emissions, affect over next 100 years



IPCC estimate — Low — Medium — High



Big image, simple whole numbers, Clear and bright – again to make the diagram accessible for the reader

Primary colours and the 4 simple steps that cause global warming make this diagram easy to understand and not daunting

Simple everyday image

Colours show the different changes on the graph. Very simple; low, medium, high.