

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 [CO₂] 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 0.8C 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?

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.

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.

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.

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".

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.

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.

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.

Kate Ravilious

Genre: Public information article – free, short science course
Audience: Relatively inexpert in the field of global warming, adults and young adults, non-scientists
Purpose: To explain global warming simply to a non-expert audience
To increase awareness of the issue
To inform people of the dangers of global warming.

Comment [JR1]: Suggests the importance of this topic as it is being discussed by highly ranked, important and serious people.

Comment [JR2]: The image of a "hot potato" suggests a problem that no one really wants in their hands, and it is just passed around until someone does something about it. This indicates that no one really wants to take responsibility for global warming.

Comment [JR3]: Very definite and straight forward statement. Shows the seriousness of it and shows readers how real and significant the situation is. The language is also colloquial and simple and full of everyday phrases such as 'here to stay' in order to make the content more accessible to inexpert readers

Comment [JR4]: Simple Question & Answer structure. Makes the article easy to read and very user friendly. Similar to a FAQ's structure.

Comment [JR5]: Simple explanation in brackets helps readers understand the jargon. This makes the article and easy read.

Comment [JR6]: Showing that the greenhouse effect can be beneficial at times as it keeps the Earth at a reasonable temperature ... however the rest of the article goes on to show how we are moving beyond this reasonable level

Comment [JR7]: Simple structure to explain to readers the jargon. Makes the article easy to understand for less expert readers.

Comment [JR8]: Simple vocabulary makes it easy for inexpert readers.

Comment [JR9]: Very definite, which shows readers how serious global warming is and how it is a significant problem and also informs the readers of the danger as "relentless" suggests you can't stop it.

Comment [JR10]: "exceptional" suggests how it has never been like this before and this a new situation, which suggests to the readers that they must do something about it now.

Comment [JR11]: Suggests that the danger is at it's worse now, because it has never been so bad in the past.

Comment [JR12]: "rapid" creates the impression of danger and creates awareness that this danger is growing quickly.

Comment [JR13]: This is a very large percentage which emphasizes the danger of global warming and is increasing awareness of how significant the problem is and the consequences that have already happened.

Comment [JR14]: Increases the readers awareness that they are the ones responsible for all this change - the focus on 'little doubt' is also mentioned to assure readers that, despite what they might have heard about disagreements over whether or not global warming is a human-induced phenomenon, most scientists actually agree that it is caused by humans

Comment [JR15]: Creates the impression that our use of fossil fuels has several negative consequences just like an addiction to drugs would. This increases awareness of the dangers that fossil fuels have as readers may only be aware of the benefits of them. "addiction" also suggests that once it's gone, we will have a huge problem, rather like an addict suffering withdrawal symptoms when they stop using drugs

Comment [JR16]: Increases awareness by informing people that they are the ones responsible for global warming as a lot of people may be oblivious to this fact.

Comment [JR17]: Makes the article seem reliable because trusted people are giving the statistics. This will make more readers believe what they are reading which means it may have a larger impact on them.

Comment [JR18]: This is a very big number which creates a sense of danger as people will find this temperature change huge. It also increases awareness of how severe the effects of global warming are.

Comment [JR19]: Creates a sense of danger as the "oceans and trees" are what are helping us reduce the global warming however the fact that they won't be able to help us anymore emphasizes the seriousness and how bad global warming really is.

Comment [JR20]: This gives the impression of ridiculously high temperatures which creates a sense of danger.

Comment [JR21]: Simple and very childish explanation. This suggests this article is also meant for younger and less expert readers. This imagery gives the readers something they can relate to as it very easy to picture so it makes the terminology easy to understand.

Comment [JR22]: This increases awareness of the severity of global warming as "20 times" more is a very large value. This also shows the readers the danger of the effects of global warming

Comment [JR23]: Scientists are supposed to be highly educated people in society who always know what to do and tell people how to solve problems. However the fact the scientists have "fear" suggests the danger of the situation is so bad, even scientists don't have the answers to solve it, which ultimately shows the readers how extreme the effects of global warming are.

Comment [JR24]: This creates the impression that just a small action can have severe consequences now and we must be careful about what we do. This increases awareness of the delicacy of global warming and informs the readers how much our actions will affect the world.

Comment [JR25]: Increasing awareness of the possible dangerous consequences of our actions.

Comment [JR26]: This informs the readers that global warming isn't something to be taken lightly. It is also warning the readers that there won't be benefits to global warming as the readers may imagine. This line sets the facts straight.

Comment [JR27]: Short and strong sentence. This firmly lets the readers know that the situation is so bad, even if we changed our habits now it still wouldn't be enough which further creates a sense of danger.

Comment [JR28]: This informs the readers that our actions already have drastic consequences. "500 years" is a very long time and it is mentioned last in this article, which means the readers are left with this number in their head. This is very effective in informing the readers of the consequences of their actions which may encourage them to change their lifestyles.