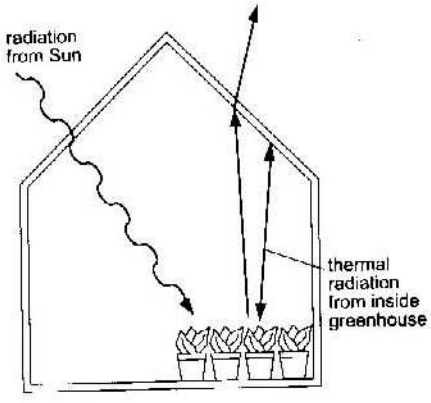
Discuss the causes of Global Warming

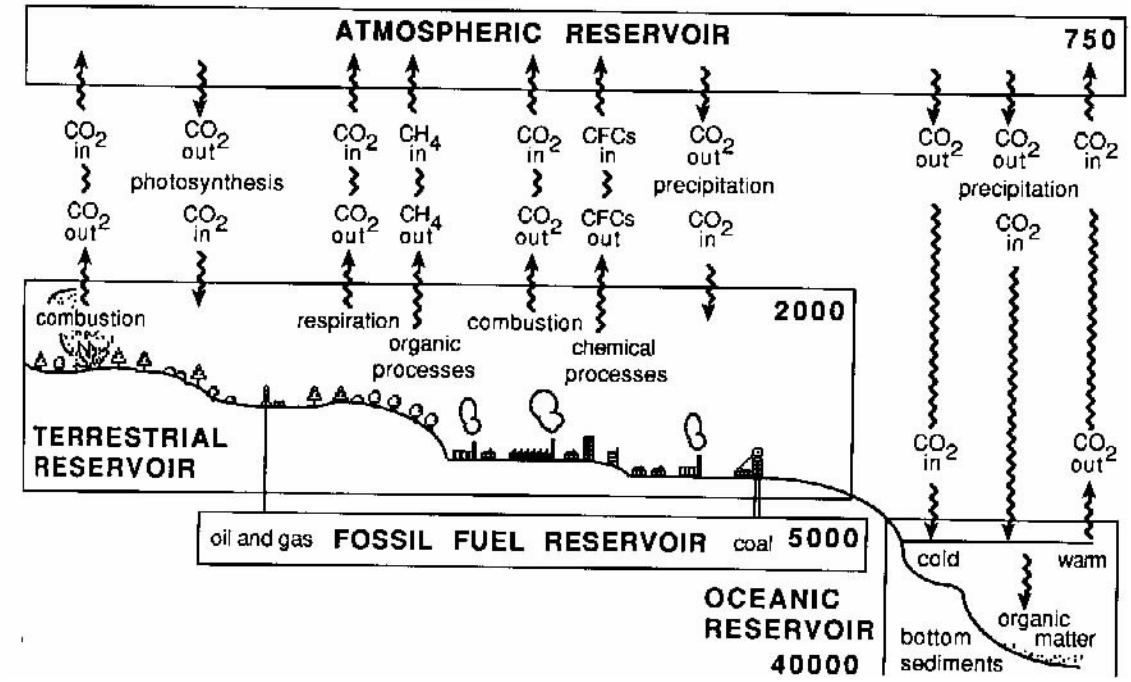
Ideally, the earth is constantly kept at an ideal temperature to sustain life of around 16°C (60°F). The earth is heated by the sun's rays in the form of visible short-wave light, the majority of these rays pass from the sun, virtually unstopped through the thermal 'blanket' of the earth's atmosphere, and heat the surface of the earth. This energy, after the earth has absorbed it, is transferred back into space as long-wave infrared energy. The 'natural greenhouse effect' is the accepted warming up of the earth that is explained by the presence of naturally occurring greenhouse gases, and has been observed on other planets (Houghton, J 1994). Global warming, however, has been and continues to be a major concern for the planet. It is the process by which the earth's surface is gradually increasing in temperature because of a variety of factors but primarily because of human activity, either by creating new sources of greenhouse gases or by obstructing natural sinks that eliminate them.

Global warming is generally considered to be to be occurring because as this energy is radiated back into space the increased thermal blanket of greenhouse gases traps it and temperatures increase globally. This thermal blanket is composed of water vapour, carbon dioxide, methane, nitrous oxide and ozone (United Nations Framework Convention on Climate Change (UNFCCC), 2001). It is also referred to as the 'greenhouse effect' as the thermal blanket acts as a form of greenhouse for the earth that absorbs radiation and is able to retain it as fig. 1 illustrates (Houghton, J 1994)



There are three main factors contributing to global warming or 'the enhanced greenhouse effect' (Kemp, D 1994). Firstly Carbon dioxide (CO_2) accounts for over 60% of global warming. It is estimated that every year 7000 million tonnes of carbon is released into the atmosphere every year (Kemp, D 1994). It is stored in fossil fuels, such as coal and oil and released when they are burnt accounting for over 5 billion tonnes of CO_2 emitted into the atmosphere every year (Keepin *et al.* 1986), it is also stored in trees and released with the burning after deforestation. This is a major concern, partly because the

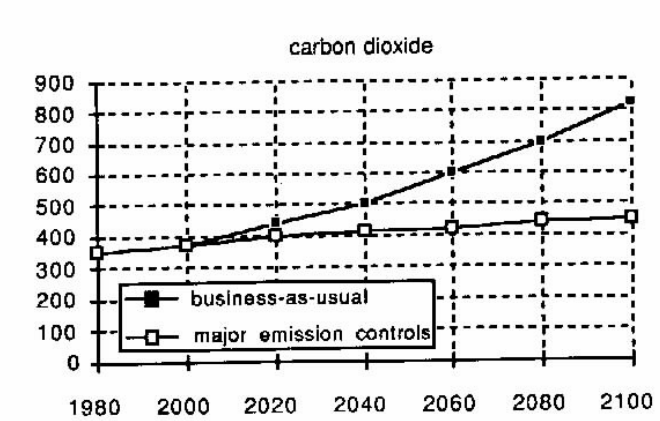
demand for land with an ever-growing population, leading to ever more deforestation, but also as plants reduce levels of CO_2 during photosynthesis, as they retain it and release oxygen into the atmosphere. This is an example of where humans disturb natural sinks as the natural process that help the earth to reduce CO_2 levels is disrupted. Fig.2 shows the flows and stores of a carbon cycle and the increased levels which contribute to global warming (Gribbin 1978, McCarthy *et al.* 1986).

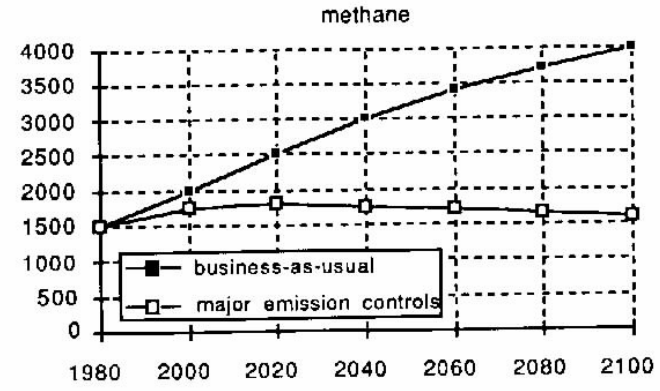


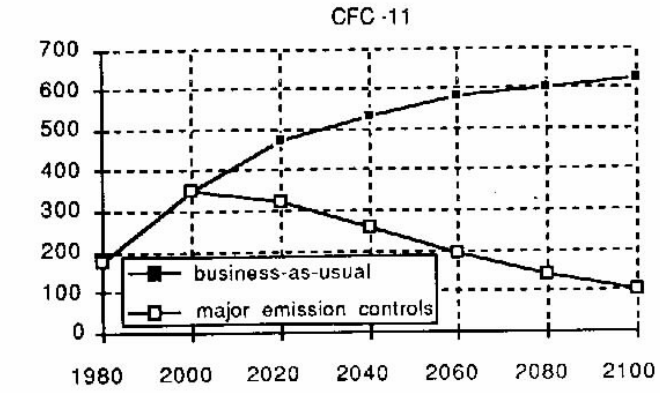
Another main cause of global warming is the release of methane into the atmosphere. This accounts for 20% of the 'enhanced greenhouse effect', it comes primarily from agriculture, especially flooded rice paddies, and animal waste, both of which coincide with the increase of CO_2 from deforestation as the pressure for land increases and more is cleared, so in turn the levels of greenhouse gases are heightened. It is difficult to make an accurate statement of how much this has affected global warming because the majority of this production is done in the developing world where research is limited, but the trend of increased global warming has followed that of the increase in rice cultivation (Watson *et al* 1990).

The final of the important factors that contribute to global warming is nitrous oxides, chlorofluorocarbons (CFCs) and ozone which together account for the final 20% of global warming. Although not as abundant as some of the other chemicals they are thought to be of the most dangerous.

For example CFC-11 is 12,000 times as strong as CO_2 (Houghton *et al*. 1990). These originate mainly from aerosol sprays, insulating foams and refrigeration appliances (Kemp, D 1994). Their widespread usage has been seen to stabilise since it's peak in the early 1990s and the installation of the Montreal Protocol agreement in 1987 which called for the reduction of CFC use and production (Houghton, J 1994). As with CO_2, though, they have a long atmospheric lifetime and it is obvious that they still contribute greatly to global warming.







We also have to consider the occurrence of what I mentioned as the 'natural greenhouse effect', and its main source is water vapour. Although not directly due to human activity it is augmented as a result of an increased greenhouse effect. The water vapour also adds to the thermal blanket that keeps the earth warm. As the temperature rises the air can hold more moisture, therefore there is an increase in water levels globally coinciding with global warming.

Of course there are those who choose to dispute the idea that global warming exists as a problem at all and among the many explanations there is the theory that it is all just in fact a natural occurrence, that the intensity from the sun has increased to correspond with that of global warming. But even though research in some areas is not as

advanced and accurate as it could be there is undoubted evidence with the rapid increase of deforestation and intensification of agriculture to name just two examples, that show there is grounds for concern and to not address it would just be irresponsible.

There have been attempts to try to lower global warming especially concerning CFCs and the emissions of CO_2 but it still remains a serious concern and it has been estimated that without any curb of the current trends the average temperature will rise by up to ¼°C every 10 years or 2½°C every century (Kemp, D 1994). Fig. 3 shows what is predicted will happen to greenhouse gas levels depending on whether we 'carry on as we are' or try to prevent it. (Houghton *et al*. 1990).

Therefore to conclude, although the 'natural greenhouse effect' does exist it is enhanced by the considerable role human activity has to play and although predictions have been made as to what the long term results will be, such as melting of polar ice caps which will cause coastal flooding and also a significant change in climate with more frequent tropical storms (UNFCCC), it can not be certain what positive feedbacks have already occurred.

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