

## Cycling Greenhouse Gases

Over the millions of years in which the greenhouse gases have been present in the Earth's atmosphere, natural cycles have ensured that the proportion of the greenhouse gases in the atmosphere has remained relatively steady. The 'cycles' consist of natural processes in which greenhouse gases are released into the air and other natural processes in which they are removed from the air.

Between these two kinds of processes, molecules of a particular gas are slowly and steadily cycled around. For example, the carbon cycle (see figure 1) refers the processes in which carbon dioxide is released into the air and the processes in which it is removed from the air.

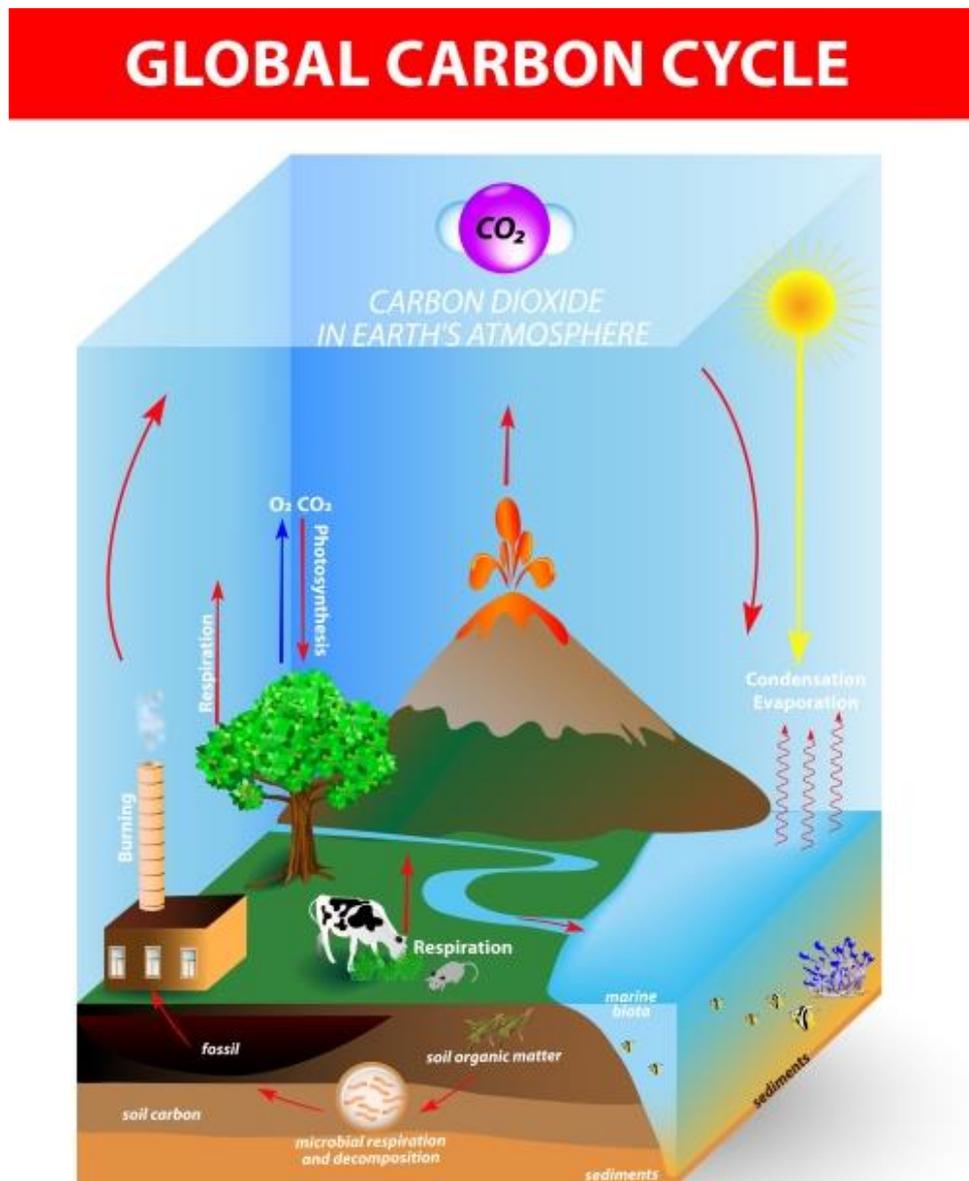


Figure 1: The carbon cycle

## ***Two processes***

One of the natural processes in which carbon dioxide is released into the air is cellular respiration, a chemical reaction that can be summarised in the following word equation:



This reaction occurs in every cell within all those living organisms that undergo cellular respiration to obtain the energy they need to survive, including animals and plants. The carbon dioxide is then released into the air, as it is a waste product that would be toxic to the cells if it were to accumulate within the cells.

One of the natural processes in which carbon dioxide is removed from the air is photosynthesis (see figure 2). This is a chemical reaction in which plants absorb carbon dioxide from the air and water from the ground to produce glucose.



The energy required for this process is obtained from light. The reaction also requires the presence of chlorophyll.

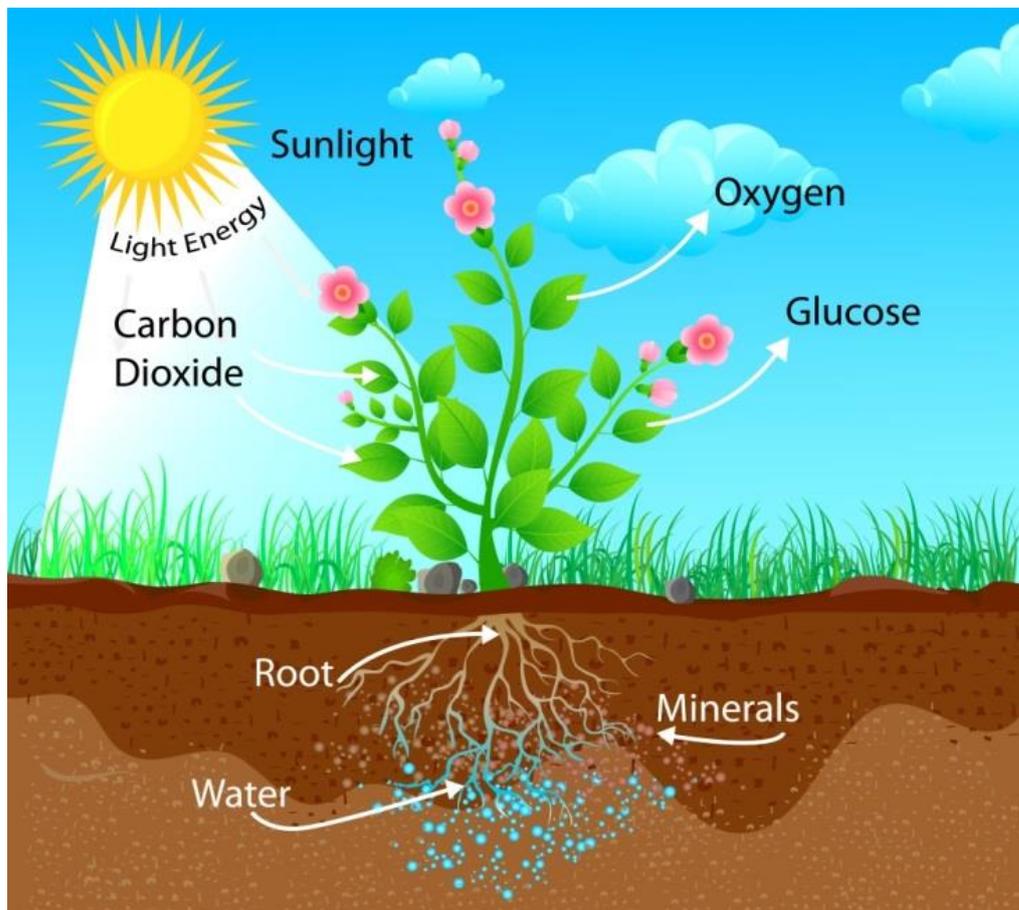


Figure 2: Photosynthesis removes carbon dioxide from the atmosphere and releases oxygen.

## ***Disturbing the balance***

Until the past century or so, all the natural processes in which greenhouse gases were released into the air and all the natural processes in which greenhouse gases were removed from the air balanced each other out. In other words, the gases were continually cycled around. As a result, the percentage of these gases in the atmosphere remained steady.

But now, the level of human activity we have today has altered this balance. Our large-scale burning of coal, natural gas and oil, our mass production of materials such as steel, cement and aluminium, and our huge piles of rotting garbage, not to mention burning trees to clear land or cutting them down to make goods (including paper), are releasing more greenhouse gas molecules into the air than can be removed in natural processes.

Even growing more and more rice and increasing the number of ruminant animals (animals that eat grass), such as sheep and cattle, to feed our increasing populations contributes to the problem. Rotting garbage, rice paddies and animals that eat grass and other plant material all produce huge amounts of methane gas, which is a far more potent greenhouse gas than carbon dioxide. (That is, a molecule of methane will absorb and re-emit more infrared radiation than a molecule of carbon dioxide.)

Insects that eat plant material or plant products such as wood or paper, add to this problem. Although each individual insect may only emit small amounts, because there are billions of them, this adds up! Termites alone contribute hugely to the problem.



Figure 3: Termite mounds emit methane – a greenhouse gas

In addition, new very potent greenhouse gases such as nitrogen trifluoride,  $\text{NF}_3$ , are being introduced into the atmosphere as new technologies are developed.

### **Did you know?**

Methane is produced by certain bacteria. In the case of rice paddies, bacteria break down dead plant material to obtain the nutrients they need. In the case of ruminant animals, bacteria live in their gut and break down the grass for them into a form they can digest. This is known as a symbiotic relationship, as both the animals and bacteria benefit from this arrangement. The methane is one of the waste products produced by the bacteria. (Unlike plants and animals, they do not produce carbon dioxide as a waste product.)