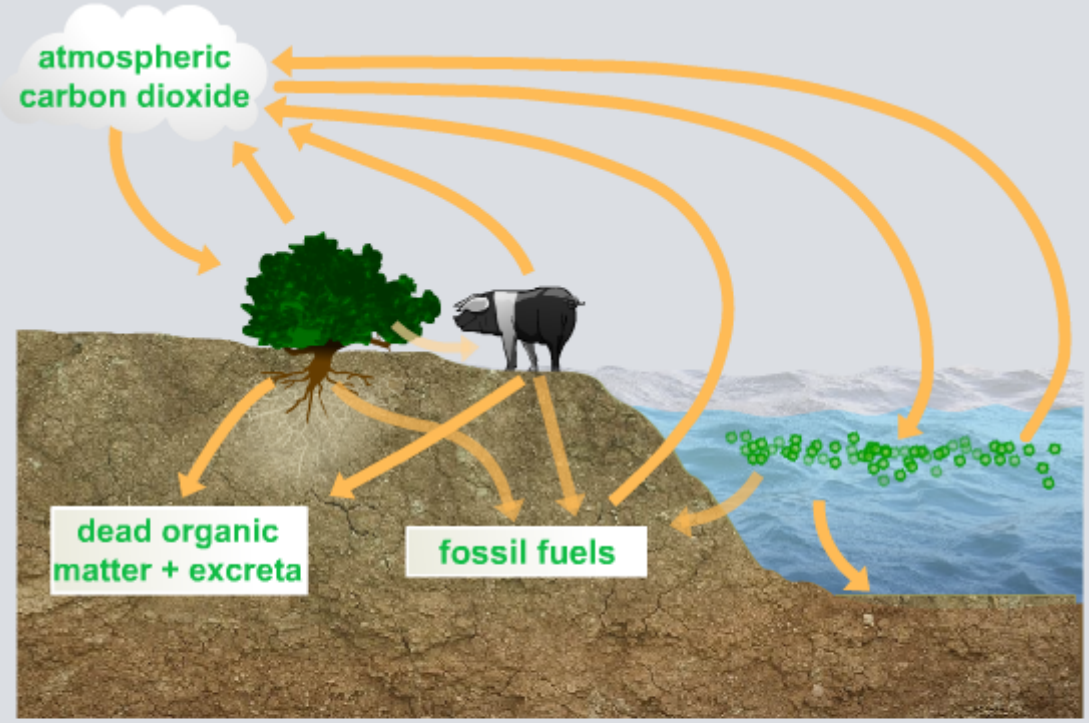
The Carbon Cycle

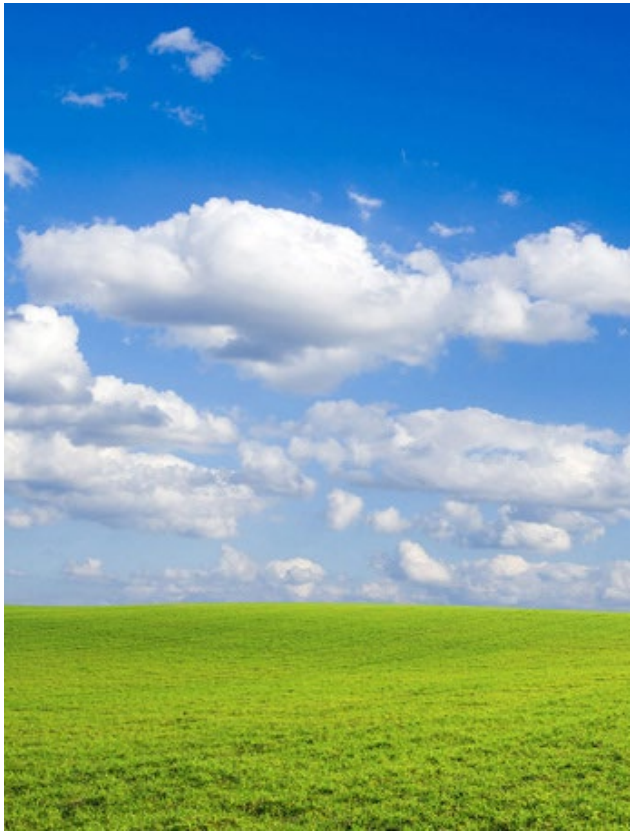


The carbon cycle

Carbon is a vital building block of all biological molecules. These molecules are synthesized by photosynthetic organisms. Carbon is returned to the atmosphere by respiration.

Organisms obtain carbon from the atmosphere. However, carbon dioxide only accounts for 0.038% of the gas in the Earth's atmosphere.

Variation in the rates of photosynthesis and respiration can give rise to short-term fluctuations in the atmospheric carbon dioxide levels.



The carbon cycle

What happens in each process?

Decomposition

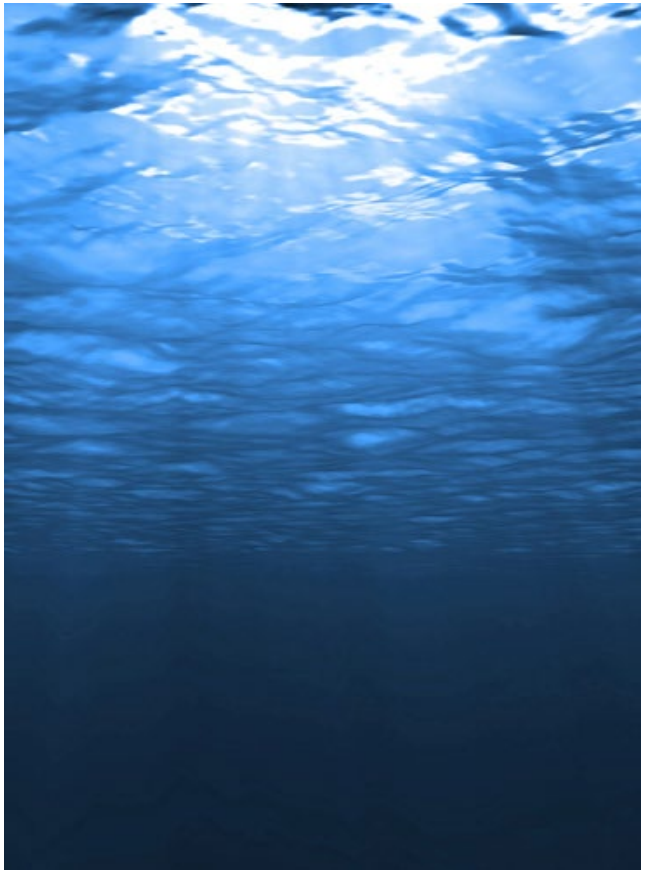
Decomposition is the breakdown of organic material into simpler compounds by **saprotrophic** microorganisms. These include some species of bacteria and fungi.

Saprotrophic or saprophytic nutrition describes how decomposers like fungi e.g. *Rhizopus* or *Mucor* (bread molds) obtain their energy.

They release **hydrolytic** enzymes from their hyphae, which break down complex carbon-containing organic molecules. The digested products can then be absorbed and used for respiration.

Oceans

Carbon dioxide moves between the atmosphere and the ocean by **diffusion**. This movement occurs when there is a difference in CO_2 gas pressure between the two.



The oceans contain more carbon than the atmosphere, because CO_2 that has diffused into the sea reacts with the water to form **carbonic acid** and its dissociation products.

This effectively reduces the CO_2 gas pressure in the water, allowing more diffusion from the atmosphere.

Effect of carbon dioxide on the oceans

The diffusion of carbon dioxide between the ocean and the atmosphere helps the atmospheric carbon dioxide levels to remain relatively constant during short-term fluctuations.

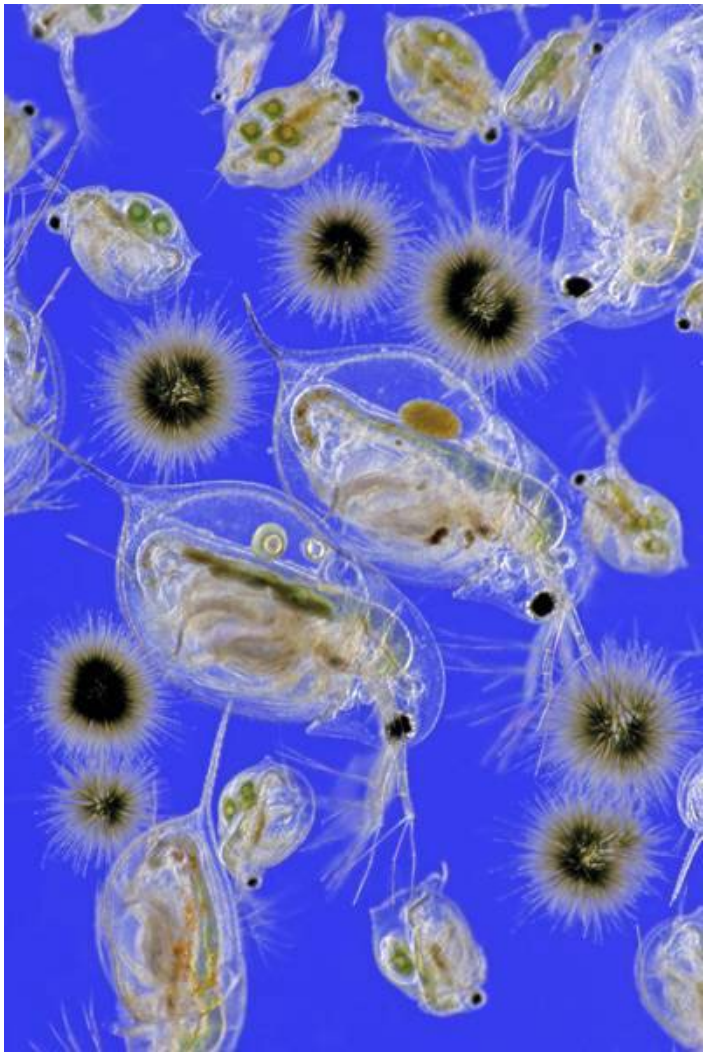
However, scientists are concerned about the impact of increased diffusion. A constant increase in carbonic acid levels and dissociation products could lead to a decrease in pH. This is known as ocean **acidification**.

It is thought that this could slow the rate of growth of coral reefs and affect phytoplankton populations.

Plankton

Marine **phytoplankton** account for a large amount of the global biological uptake of carbon dioxide. They absorb carbon dioxide and release oxygen during photosynthesis.

Plankton use carbon to produce **calcium carbonate** ($CaCO_3$) **shells**. When plankton die, their shells sink to the ocean floor and are buried in the sediment. Over time this can form limestone and chalk, locking away the carbon.



Human activity

Globally the concentration of carbon dioxide in the atmosphere has increased over the last few hundred years.

This is thought to be influenced by human activity. The combustion of fossil fuels and **deforestation** have contributed to the increase.

Deforestation has removed huge numbers of photosynthesizing plants. This then causes less carbon dioxide to be removed from the atmosphere by biomass.

Global flows of carbon