



CLIMATE CHANGE

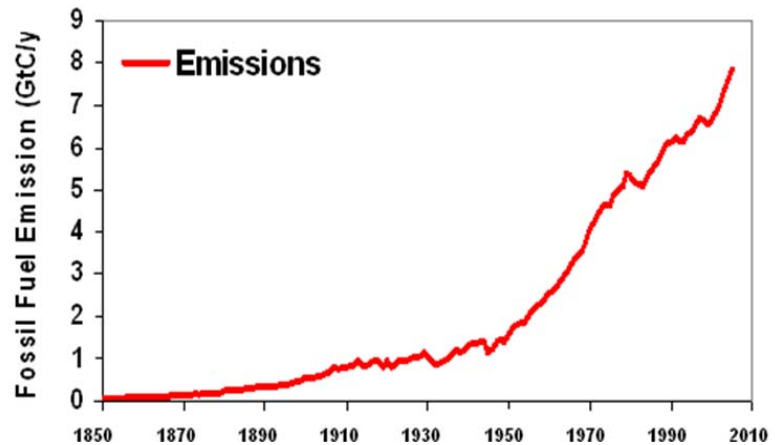
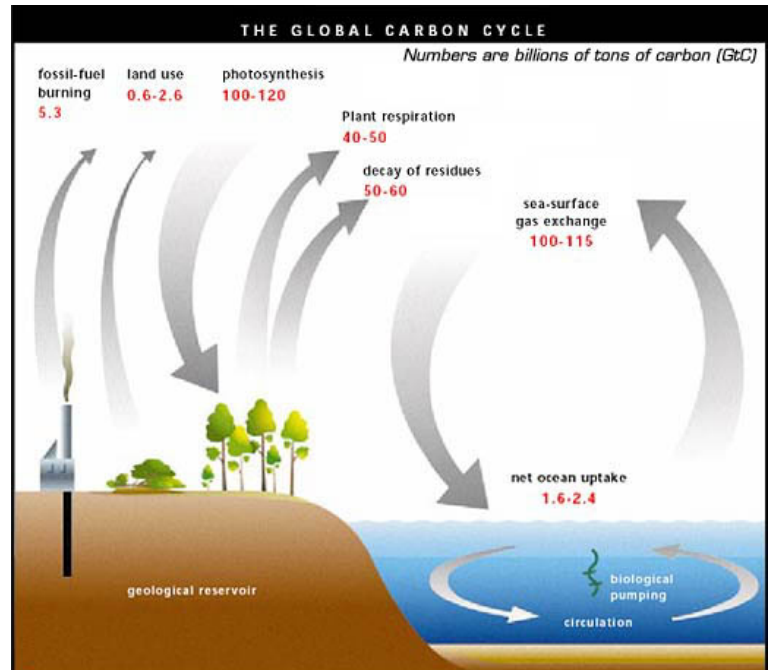
The Carbon Cycle & Carbon Sinks

Fact Sheets for Home & School



The Carbon Cycle

1. Life exists on Earth thanks to Nature's cycles running smoothly. Together these cycles balance and regulate this planet's systems and atmosphere.
2. **Carbon, Hydrogen, Oxygen and Nitrogen are the main elements of life.** These and other elements flow constantly through the atmosphere, air, land, sea, plants and animals – being cycled and recycled.
3. The Sun's energy drives most of these natural cycles which in turn, sustain life.
4. The concentration of carbon in living matter (18%) is almost 100 times greater than its concentration in the earth (0.19%). So living things extract carbon from their non-living environment. For life to continue, this carbon must be recycled.
5. Carbon is the fourth most abundant element in the Universe and is the building block for all living things. The conversion of carbon dioxide into living matter and then its absorption into the atmosphere, oceans or soil are the pathways of the carbon cycle. Plants draw about one quarter of the carbon dioxide out of the atmosphere and photosynthesize it into carbohydrates.
6. Since measurements of atmospheric CO₂ began late in the nineteenth century, its concentration has risen over 20%. This increase is probably "anthropogenic"; that is, caused by human activities:
7. Burning fossil fuels (coal, oil, natural gas) return carbon that had been locked within the earth for millions of years to the atmosphere.
8. Clearing and burning of forests, especially in the tropics, releases vast quantities of carbon back into the atmosphere. In recent decades, large areas of the Amazon rain forest have been cleared for agriculture and cattle grazing.
9. The **global carbon budget** is the balance of the exchanges (incomes and losses) of carbon between one specific loop (e.g., atmosphere - biosphere) of the carbon cycle.
10. A carbon sink is an area where more carbon is collected than produced while a carbon source produces more carbon than is collected.



The amount of Carbon we are adding to the atmosphere is going up faster now than at any other time in the last 200,000 years.
IPCC 2007



Global Carbon Emissions

Three-quarters of human-caused emissions of carbon dioxide are due to the combustion, or burning of fossil fuels.

Efficiency of Natural Sinks (2000-2005)

48% of all CO₂ emissions accumulated in the atmosphere



The Airborne Fraction

The fraction of the annual anthropogenic emissions that remains in the atmosphere

52% were removed by natural sinks

Oceans remove – 26%



Land removes – 26%



Canadell et al. 2007, PNAS, in review

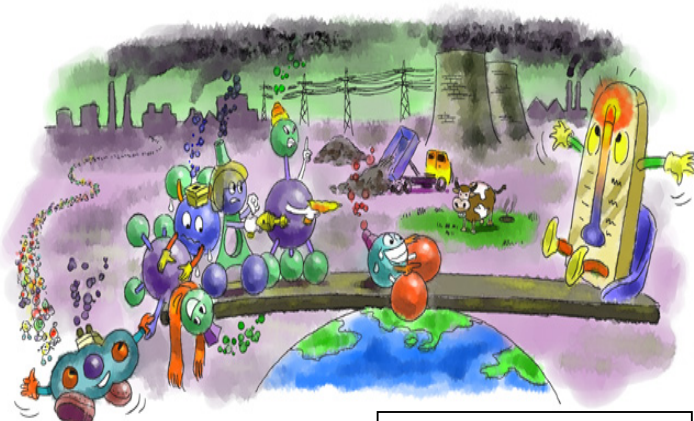


While just under half of the carbon dioxide we produce remains in the atmosphere, just over half is collected and stored by the oceans and forests combined.

Both are natural sinks... collecting the carbon dioxide released into the atmosphere.

Natural CO₂ sinks, like forests and oceans, are a free service provided by the planet. They provide an effective **52% emissions reduction** worth **US\$300 billion per year** if we had to provide it ourselves through mitigation measurements (assuming \$20/ton CO₂ equivalents)

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What's your problem? Man?

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Carbon Sinks

1. What's a Sink?

One of the most important Greenhouse Gases is carbon dioxide. In the atmosphere, carbon - as CO₂ - helps to set planet's thermostat. Too little, and the planet would freeze... too much and it will cook. For millions of years, the level of CO₂ in the atmosphere has been more or less in balance.

- To help keep the right balance of carbon, our planet has cleverly created carbon sinks – *no - that's not where you go to do the washing up.*
- Carbon sinks are huge areas which collect carbon. The oceans, forests and soil are all major carbon sinks: they absorb about half of the carbon that humans produce each year.
- Carbon sinks help to keep the climate and temperatures in balance. They collect the extra carbon released into the atmosphere and store or 'sequester' it safely away.
- The concept of carbon sinks is based on the natural ability of trees, other plants and the soil to soak up carbon dioxide and temporarily store the carbon in wood, roots, leaves and the soil.
- Soils ain't just soils* - Out of sight but working hard: carbon as plant organic matter is sequestered in soils. Soils contain more carbon than is contained in vegetation and the atmosphere combined.
- Mature forests, made up of a mix of various aged trees as well as dead and decaying matter may be carbon neutral above ground. Below the surface, in the soil, the gradual build-up of slowly decaying organic material will continue to accumulate carbon, but at a slower rate than an immature forest.
- Forest fires release the absorbed carbon back into the atmosphere.

Facts

- Humans release about 6 billion tonnes of carbon - *mostly from burning fossils* - into the atmosphere each year. The oceans absorb around 25% of all carbon emissions, but they are slowly becoming acidic.
- Oceans are natural CO₂ sinks, and represent the largest active carbon sink on Earth. The Southern Ocean is one of the biggest sinks, absorbing 15% of CO₂ emissions.
- Carbon dioxide is incorporated into forests and forest soils by trees and other plants. Through photosynthesis, plants absorb carbon dioxide from the atmosphere; store the carbon in sugars, starch and cellulose, and release the oxygen into the atmosphere.
- Thanks to the natural ability of trees, other plants and the soil to soak up carbon dioxide and temporarily store the carbon in wood, roots, leaves and the soil, tree clusters and forests help to reduce the extra amount of Greenhouse gases in our environment.