Three Nations ENERGY

FACT SHEET: Carbon Sinks & Sources

(Basic)

The well-being of our planet depends on carbon and how it cycles through the Earth's air, oceans and land. There has been a natural balance between how much carbon is released and stored but human activity has caused this balance to be thrown off. To better understand this problem, you need to know about sources and sinks.

Source

- Any activity that releases carbon dioxide (CO_2) into the atmosphere is called a carbon "source". A source gives off more than it takes in.
- Natural sources include volcanoes, fires, breathing, decay, digestion and some from oceans and freshwater bodies.

Sinks

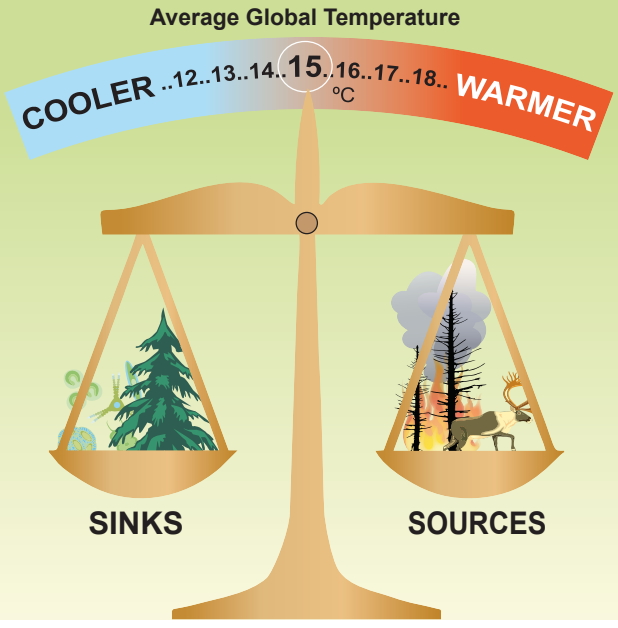
- Any activity that absorbs carbon dioxide is called a carbon "sink". A sink absorbs more carbon than it gives off
- Natural sinks for CO_2 include plants, especially forests, oceans and freshwater bodies, fossil fuels and carbonate rocks.

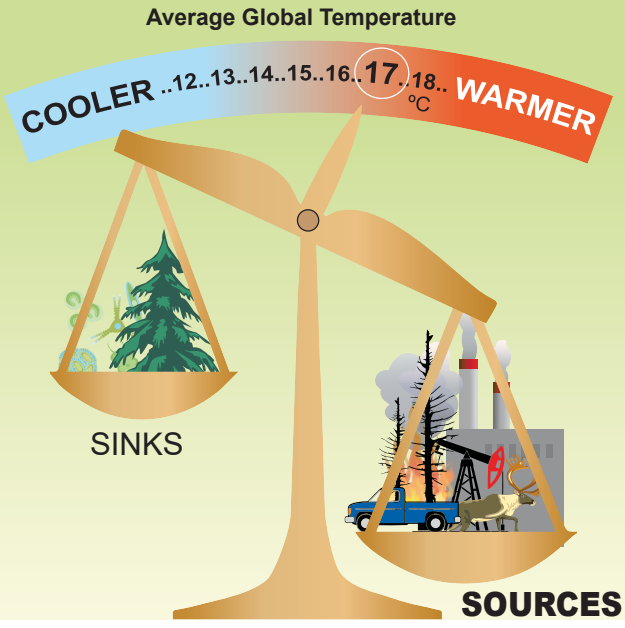
Balance

- Carbon is constantly recycled between these different "sinks" and "sources."
- The amount of carbon in the atmosphere depends on the balance between the sinks and sources.
- This system of sinks and sources operates all over the planet and is known as the carbon cycle.
- Before the Industrial Revolution, the amount of carbon moving between trees, soil, oceans and the atmosphere was relatively balanced.

The well-being of our planet depends on carbon.

Sources & Sinks - Greenhouse Gases in Balance





Important Sinks

Forests

- Land plants account for about 25% of the carbon taken out of the atmosphere.
- Plants use sunlight and take in carbon to make sugars which act as their food (photosynthesis). This “food” is used to make the trunks, branches, roots and leaves - all made with the carbon that was taken from the atmosphere.
- For the past century, Canada’s managed forests have been a significant carbon sink, steadily removing carbon from the atmosphere. In recent decades, however, Canada’s forests have often become carbon sources, releasing more carbon into the atmosphere than they stored.
  - Cutting down forests is reducing the size of this sink, allowing more carbon dioxide to remain in the atmosphere.
  - Carbon is released when trees burn or when they decay as a result of clear cutting.
  - The areas burned by wild fires has been increasing.
  - Unusual insect outbreaks have occurred due to the warming trends in the weather.

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The Canadian Encyclopedia

Lakes, Seas and Oceans

- Approximately 25% of the carbon dioxide from the air is absorbed by the oceans.
- Colder water can absorb higher amounts of CO_2 so if the water is warmed, it holds less carbon dioxide.
- If the ocean has more CO_2 than the atmosphere above it, CO_2 is released back into the atmosphere.
  - Increased CO_2 increases ocean acidity, which is harmful to many marine species, especially calcifying organisms including corals, shellfish and phytoplankton
- Aquatic plants in lakes and oceans use carbon dioxide to make food and store it, just like land plants (photosynthesis).

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Underground

- When the plants die, the carbon remains stored in the dead material, which breaks down and becomes part of the soil.
- When ancient marine organisms died, their remains sank, forming sediment on the ocean floor and under great pressure over millions of years, turned into limestone, which is the largest carbon reservoir on Earth.
- Remains of ancient plants and animals were buried under layers, subjected to great pressure over millions of years to form fossil fuels such as oil, coal, and natural gas. These are also major sinks for carbon.

Land plants account for about 25% of the carbon taken out of the atmosphere.

Another 25% is absorbed by oceans and lakes.

Important Sources

Natural Sources

- Most living things break down sugar to produce energy (respiration) and give off CO_2.
- Many small living things in the Earth's soil break down dead plants and animals. These also release carbon dioxide.
- The oceans contain dissolved carbon dioxide, which is released into the air at the sea surface, but they can also absorb it.
- A minor amount carbon dioxide is released by volcanic eruptions.

Artificial Sources - Throwing Off the Balance

Human activities are changing natural carbon sinks into carbon sources;

- Drilling, mining and processing oil, gas and coal has caused the greatest increase in carbon emissions.
  - Since the beginning of the Industrial Revolution, when people first started burning fossil fuels, carbon dioxide in the atmosphere have increased 39 percent - the highest amount in two million years.
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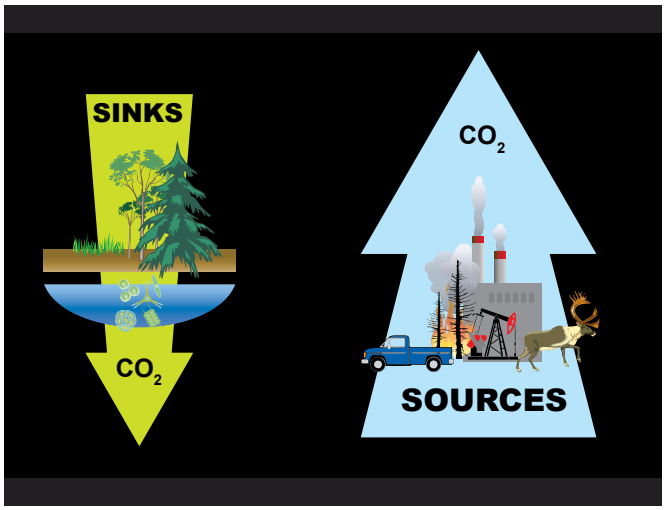
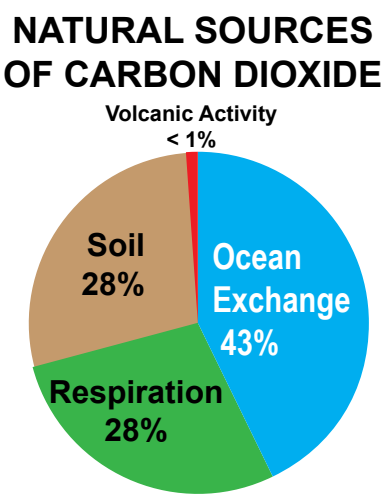
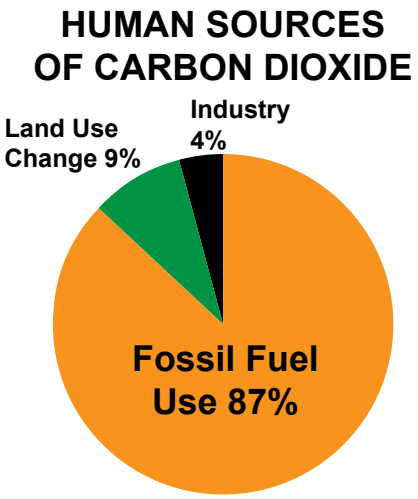
- Clearing of forests for farming and logging results in:
  - loss of a dense growth of plants that had stored carbon in wood, stems, and leaves.
  - loss of plants that would otherwise take carbon out of the atmosphere as they grow.
  - replacement of the dense growth with crops or pasture, which store less carbon.
  - exposure of soil that then releases carbon from decayed plants into the atmosphere.
  - drainage of wetlands, peat bogs and grasslands, which also releases more carbon dioxide
- Industrial Activity
  - Cement production produces the most CO_2 of all industrial processes when limestone is chemically changed by heating it to very high temperatures.
  - Steel production requires iron to be melted and refined to lower its carbon content, which uses oxygen to combine with the carbon resulting in the release of large amounts of carbon dioxide.
  - Products like plastics, solvents, and lubricants are created using petroleum. These products evaporate, dissolve, or wear out over time, releasing even more carbon dioxide.







Time & Balance

- The cycling of carbon between the atmosphere, plants and animals can take place quickly, over the space of days.
- Other parts of the cycle, especially those involving the storage of carbon underground, may take millions of years to complete.
- Human activity is disrupting the carbon cycle balance. The amount of carbon being stored in sinks is no longer equal to the amount produced by sources
- This is leading to an increase in the amount of carbon in the atmosphere as humans produce carbon dioxide far faster than the natural sinks can absorb it.
- The greater the amount of carbon dioxide in the atmosphere, the greater the warming from the greenhouse effect.

More Resources

Main sources of carbon dioxide emissions - What's Your Impact

https://whatsyourimpact.org/greenhouse-gases/carbon-dioxide-emissions

"Planting Trees can't counter carbon emission" - CBC

https://www.cbc.ca/news/technology/trees-carbon-emissions-bob-mcdonald-1.4132679

Videos

What are carbon sinks? | Sustainability for all - ACCIONA

https://www.youtube.com/watch?v=OoW2PIvMpZs

"A breathing planet off balance" - NASA

https://www.youtube.com/watch?v=xk11DVaAjEA#action=share