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What is the carbon cycle?

Carbon is an essential element and makes up all life on this Earth. It is in you and me, in the trees around us, in the soil beneath your feet, and in the deep ocean. It moves constantly from state to state and compound to compound, creating a cycle within the Earth's system. You can picture carbon's movement among the Earth's systems as a flow in and out of reservoirs. A source is a reservoir that releases carbon and a sink is a reservoir that absorbs carbon. Carbon reservoirs store carbon for varying amounts of time—it can be as short as days or as long as hundreds of millions of years, such as carbon in coal deposits.

What are fossil fuels?






Reproduction of Carboniferous-era forest. Photo from exhibit at the Museum of the Earth.

Fossil fuels, the foundational source of our industrial energy systems, trace their origin back to the sun. The process starts with photosynthesis in plants, where carbon dioxide from the atmosphere, water, and sunlight combine to create organic matter. During the Carboniferous era (approx. 359 to 299 million years ago), for example, abundant plant life thrived. Over millions of years, under specific conditions, this organic matter was preserved through sedimentation, becoming buried within the Earth's crust. The immense pressure and heat underground result in the formation of coal. Today, we extract coal, oil, and natural gas by drilling below the Earth's surface, tapping into the energy stored millions of years ago.

Fossil fuels are an anthropogenic source of CO2 emissions

Fossil fuel reserves have been harnessed and extensively burned for energy, industrial processes, and transportation. The production and combustion of fossil fuels since the Industrial Revolution has released carbon dioxide (CO2) and other greenhouse gases into the atmosphere at a rate unprecedented in geologic history, significantly changing the atmosphere's gaseous makeup. This makes these fuels an anthropogenic—which means influenced by humans—cause of climate change.

The rapid extraction and consumption of fossil fuels, relative to the millions of years it took for them to form underground, underscores their non-renewable nature. Once extracted and consumed, they cannot be replenished within human timescales. Their depletion is worrisome due to their widespread use across society, and if we do not change our energy mix and lifestyle, we will struggle to fulfill future energy needs as well as heating the planet. Luckily, we have plentiful renewable energy sources such as the sun, wind, and heat from within the Earth.

Fossil Fuel	State of Matter	Energy Density	CO ₂ Emission	Uses
 NAT. GAS	Gas	42-55 MJ/kg	117 pounds per million Btu	Electricity, heating, industry
 COAL	Soild	24 MJ/kg	211 pounds per million Btu	Electricity, heating, industry
 OIL	Liquid	42-47 MJ/kg	163 pounds per million Btu	Transportation, heating, industry

Impacts

Air Quality and Human Health

- Oil is the largest source of global air pollution and smog, greatly reducing air quality.
- Air pollution sources include oil and coal mining as well as burning wood.
- Health conditions such as stroke, heart disease, and lung disease are linked to pollution sources.
- Children raised in areas with polluted air face increased risk of chronic lung issues as adults.



Photo by [Max Zhang](#) on [Unsplash](#)

Hazards

- Coal mining and oil extraction expose workers and nearby residents to toxins, leading to health issues such as black lung disease and cardiopulmonary problems.
- Workers face injuries like burns, fractures, and spinal damage
- Oil spills damage habitats and fisheries.
- Fracking poses seismic threats, especially in regions like Oklahoma, where 2% of earthquakes stem from hydraulic fracturing operations.



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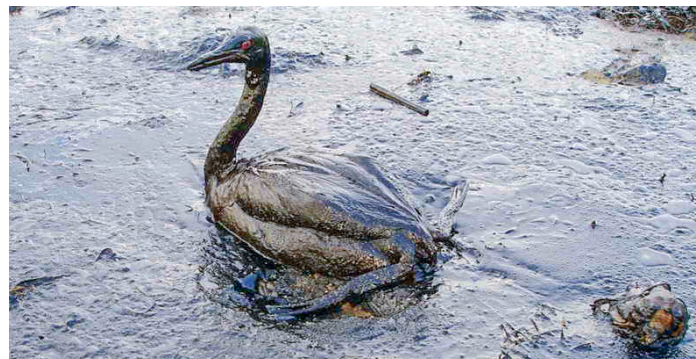


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CHANGING CLIMATE

OUR FUTURE, OUR CHOICE



Fossil Fuels in the Carbon Cycle



MUSEUM OF THE EARTH

1259 Trumansburg Rd.
Ithaca, NY 14850
(607) 273-6623 [priweb.org](#)



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Water Pollution

- Coal mining, oil spills, runoff, and fracking fluids pollute water sources, posing risks to ecosystems and human health.
- Wastewater containing heavy metals like arsenic, lead, and copper threatens waterways and aquifers, potentially causing cancer, birth defects, and neurological harm.
- Ocean acidification, caused by CO₂ emissions from fossil fuel combustion, harms marine ecosystems.

Refer to the pamphlet "[Oceans in the Carbon Cycle](#)" for more information on ocean acidification.