

Earth Science IV

1. WATER CYCLE
2. CARBON CYCLE

Video

- https://www.youtube.com/watch?v=OCzYdNSJF-k&ab_channel=TED-Ed

Matter Cycles

Matter cycling occurs when matter moves from one place to another on Earth.

Matter can cycle throughout the Earth both naturally and through human activities.

In this unit, we will be discussing four major matter cycles: water, carbon, nitrogen, and phosphorus.

Water Cycle

Water is everywhere on Earth's surface in the form of ponds, lakes, rivers, oceans, snow, and ice.

It can also be found under Earth's surface in the form of ground water and in the air as water vapour.

Water Cycle

All water continuously cycles through ecosystems through three main processes:

- **Evaporation**: Heat from the Sun causes water at Earth's surface to evaporate changing liquid water into water vapour
- **Condensation**: As warm air rises, it cools and condenses into water droplets or ice crystals, forming clouds
- **Precipitation**: Water falls back to Earth's surface when it rains, snows, sleet, or hails

Water is able to travel along Earth's surface as 'run-off'; it will move downhill back into the ocean due to gravity.

Water Cycle

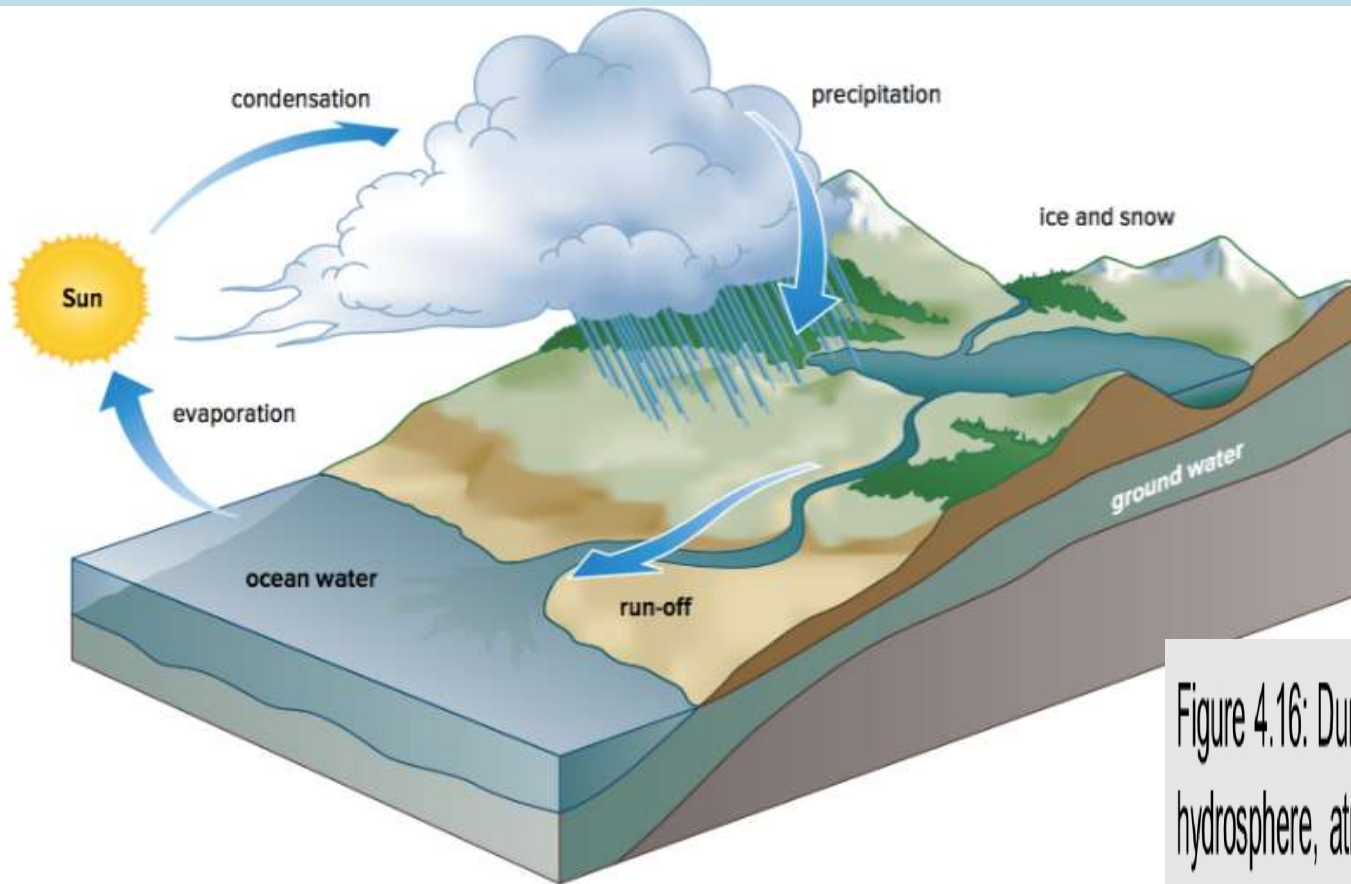


Figure 4.16: During the water cycle, water is exchanged among the hydrosphere, atmosphere, and geosphere.

Water Cycle

Water can also travel through the biosphere by a process called transpiration.

Transpiration occurs when water is absorbed by the roots of a plant, carried through it, and eventually it will evaporate through small pores in the leaves.

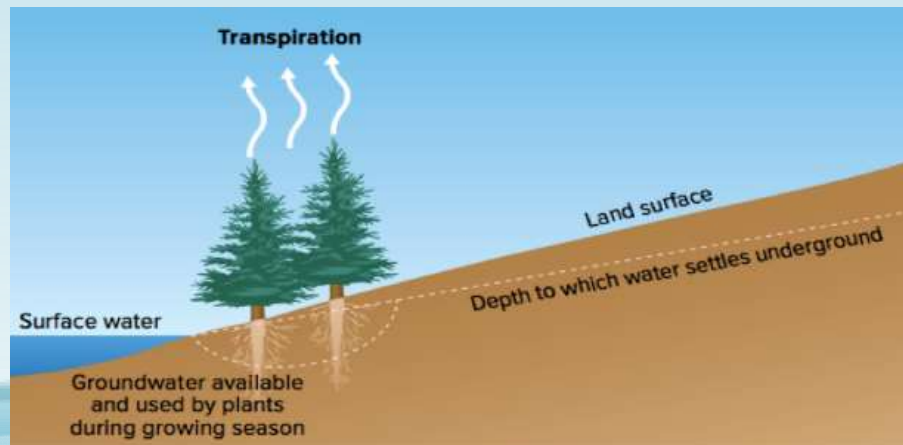


Figure 4.17: Studies show that about 10% of water vapour in the atmosphere is released by plants.

Video

- https://www.youtube.com/watch?v=KM-59ljA4Bs&ab_channel=GoNoodle%7CGetMoving

How have humans impacted the water cycle?

Water can be polluted when the water quality of both fresh and salt water have been changed.

This can result in negative effects on organisms and can make water unsuitable for its desired uses.

Types of Pollution

There are two major types of pollution:

- Point source pollution: a single identifiable source of pollution that pollutants come from
 - Examples: factories, power plants, sewage treatment plants, oil wells
- Non-point source pollution: a source of pollution that is difficult to track where it comes from; these pollutants are released in a wide area
 - Examples: run-off from farms, construction sites, parking lots



Effects of Pollution

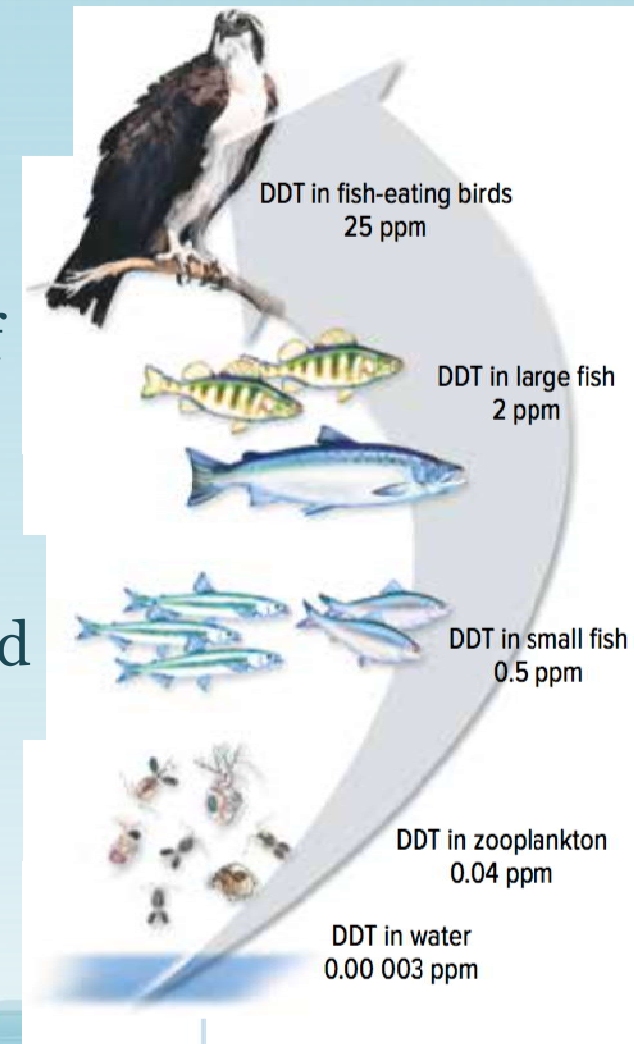
When pollutants enter into the environment, it is difficult for it to break down.

When micro-organisms (phytoplankton, bacteria) eat pollutants in the water (such as pesticides, plastics, etc.), it will collect in its cells and body tissues.

This can lead to bioaccumulation and biomagnification.

Effects of Pollution

- Bioaccumulation: the process where pollutants collect in the cells and tissues of organisms
- Biomagnification: the increase in concentration of pollutants in tissues of organisms that are at higher levels in a food chain or food web



Video

- https://www.youtube.com/watch?v=4vJ_1ojjlxw&ab_channel=MelissaLandeem

Carbon Cycle

Carbon cycles through both abiotic and biotic factors. In the carbon cycle, carbon predominantly exists in the form of carbon dioxide gas (CO_2).

- Carbon dioxide gas moves from the atmosphere into the biosphere through photosynthesis and cellular respiration
- Carbon dioxide also moves back to the atmosphere when organisms die and decompose
- Carbon enters the geosphere when the remains of organisms are trapped under sediment layers

Carbon Cycle

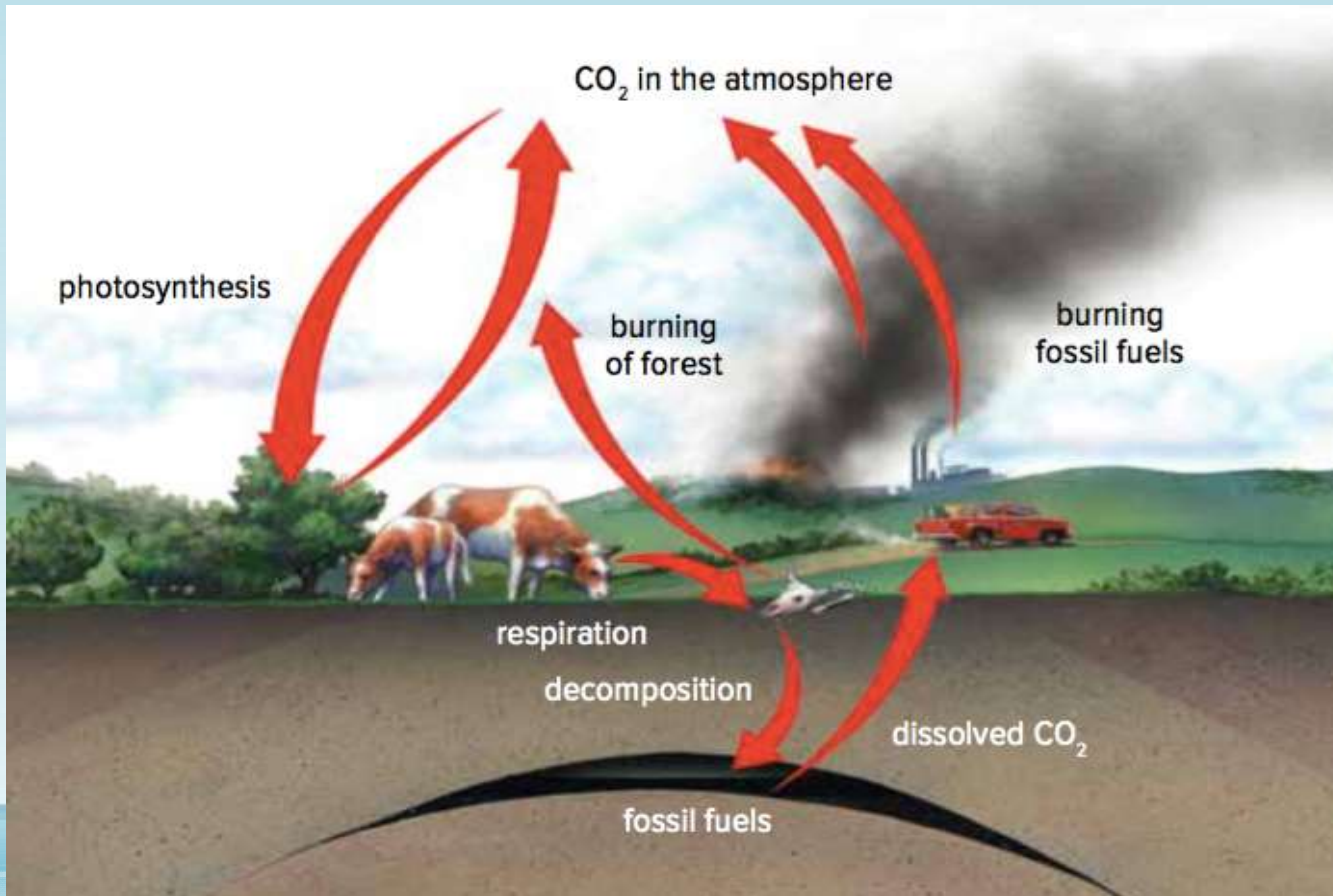


Figure 4.20: During the carbon cycle, carbon is exchanged among the biosphere, atmosphere, and geosphere.

Video

- <https://www.youtube.com/watch?v=Xzofn81BIIQ>

Carbon Cycle

Carbon can also be stored in order to be used for later.

- Some carbon is stored in the woody tissue of living trees
- Some carbon is stored in the decomposing remains of organisms buried deep in the ground
 - Over time, this stored carbon transforms into carbon-rich fossil fuels (coal, oil, natural gas)

How have humans impacted the carbon cycle?

The amount of carbon dioxide used by photosynthesis and given off by cellular respiration is nearly the same (carbon dioxide is balanced).

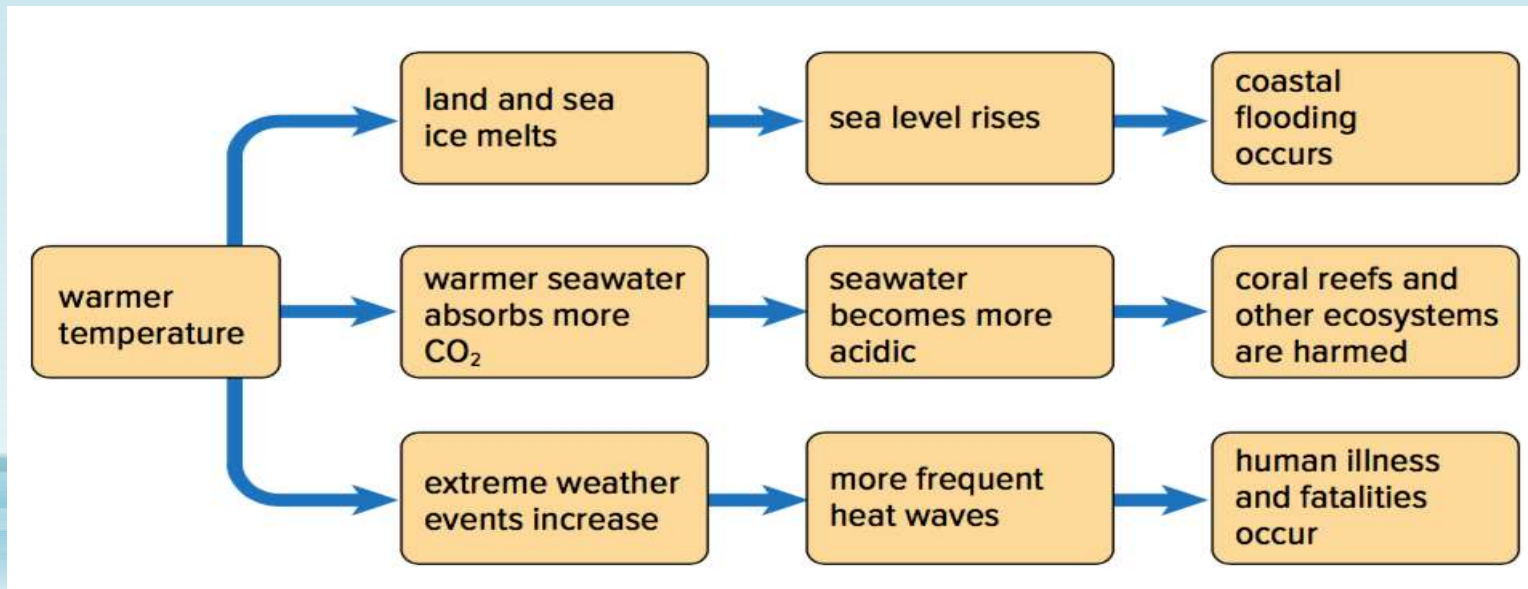
Over time, human activities (such as burning fossil fuels, burning trees) have impacted the carbon cycle by releasing excess carbon into the atmosphere. This excess carbon has led to global warming and global climate change as carbon dioxide is a greenhouse gas that traps heat in the atmosphere.

- **Global warming:** An increase in the average temperature of Earth's surface
- **Global climate change:** A long-term change in Earth's climate

The Effects of Excess Carbon

Earth's surface temperature: Increased by between 0.56°C and 0.92°C in the past 100 years

- This “small” change can affect conditions in all of Earth's spheres



The effects of rising sea level

- Some islands have gone underwater
- Salt water gets into the drinking water supply
- Coastal flooding and destruction of wetlands

The effects of changing ocean chemistry:

- Ocean becomes more acidic because it absorbs more carbon dioxide from the air
- An acidic and warming ocean can destroy coral reefs and corals themselves (acidity dissolves the organisms' shells)

The Amazing Nutrient Cycle Activity

PRETEND YOU'RE A CARBON ATOM.
YOU WILL START SOMEWHERE ON/ABOVE/UNDER EARTH AND PROCEED
ON A JOURNEY FROM THERE.

ROLLING THE DICE WILL DETERMINE WHAT HAPPENS TO YOU.
RECORD WHAT HAPPENS ON YOUR WORKSHEET.

WE WILL GO TO THE SUPERLAB. PICK A PLACE TO START YOUR
ADVENTURE; ONLY 2 STUDENTS MAX AT ONE STATION TO START. WRITE
THE PLACE YOU START AT #1 ON YOUR SHEET. EVERY TIME YOU MOVE,
WRITE NOTES ON YOUR SHEET ABOUT WHAT HAS HAPPENED TO YOU.

Does the journey ever end?