The Water Cycle

A Science A–Z Earth Series

Word Count: 1,588

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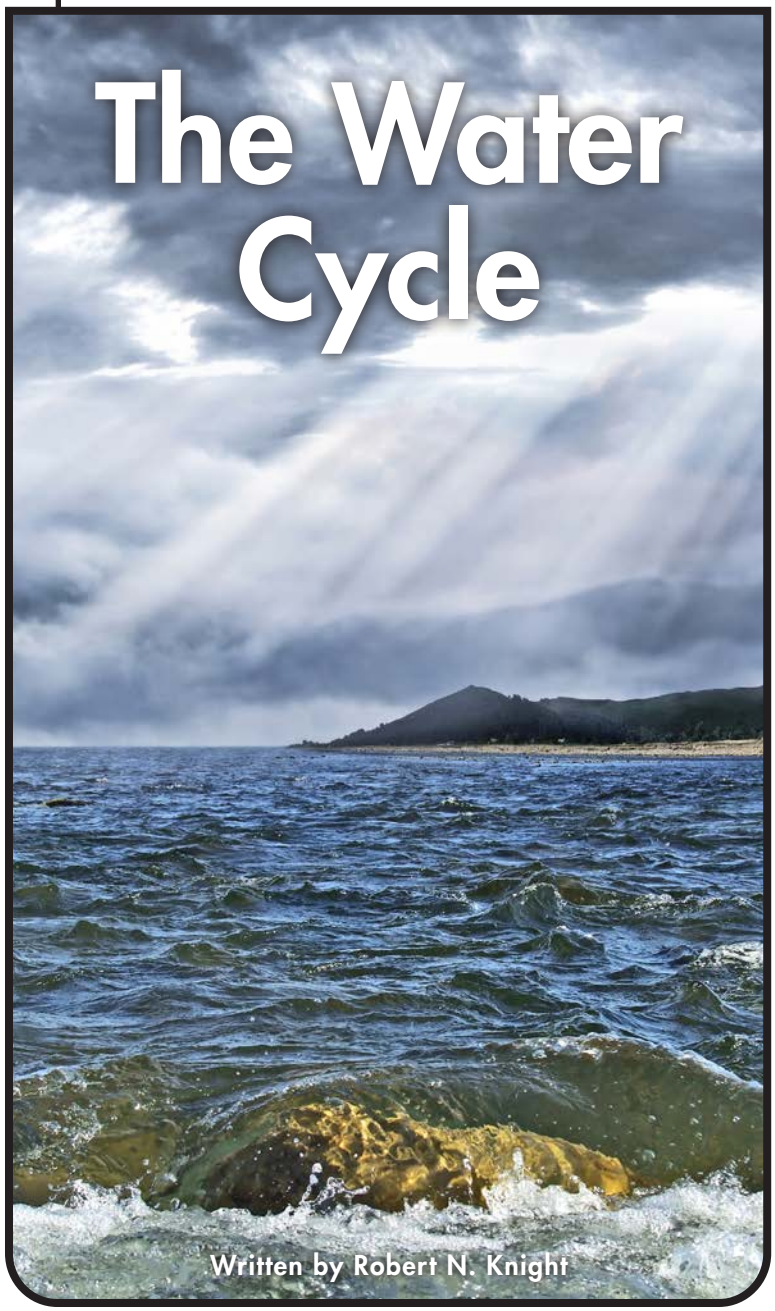

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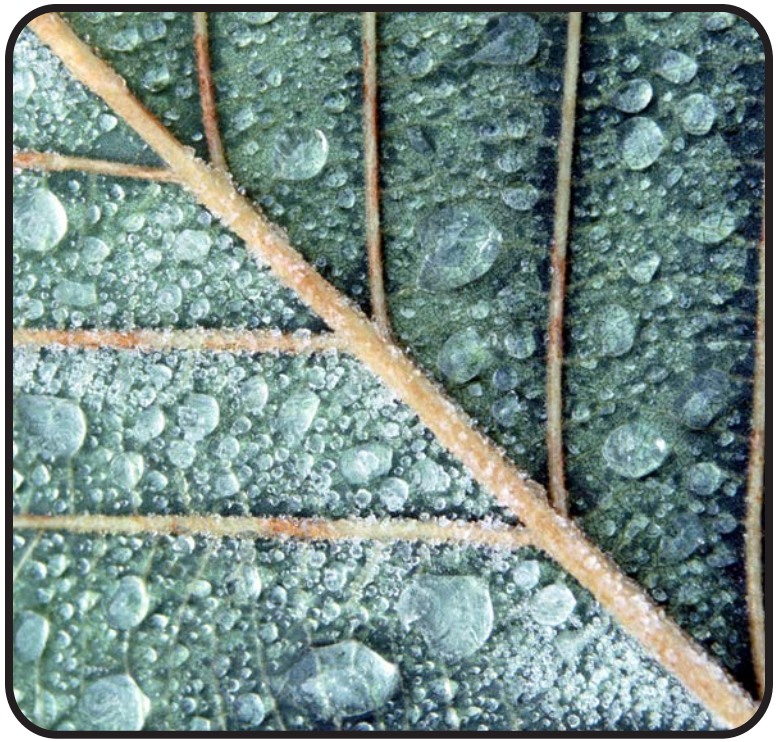

Written by Robert N. Knight

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KEY ELEMENTS USED IN THIS BOOK
The Big Idea: Understanding the water cycle is crucial to understanding how what we do with water—polluting, farming, damming, using, wasting, conserving—affects everyone's water.
Key words: absorb, aquifer, cloud, condensation, conservation, cycle, dam, delta, deposition, Earth, energy, erosion, evaporation, flow, freeze, fresh water, gas, glacier, groundwater, hail, ice, irrigation, lake, liquid, melt, ocean, polluted, precipitation, rain, river, runoff, salt water, sandbar, sediment, sleet, snow, soil, solid, state of matter, storm, stream, surface water, temperature, water, water cycle, water molecule, watershed, water vapor, well **Key comprehension skill:** Cause and effect *Other suitable comprehension skills:* Sequence events; main idea and details; interpret charts, graphs, and diagrams; author's purpose **Key reading strategy:** Summarize *Other suitable reading strategies:* Visualize; connect to prior knowledge; retell; ask and answer questions

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cirrus clouds

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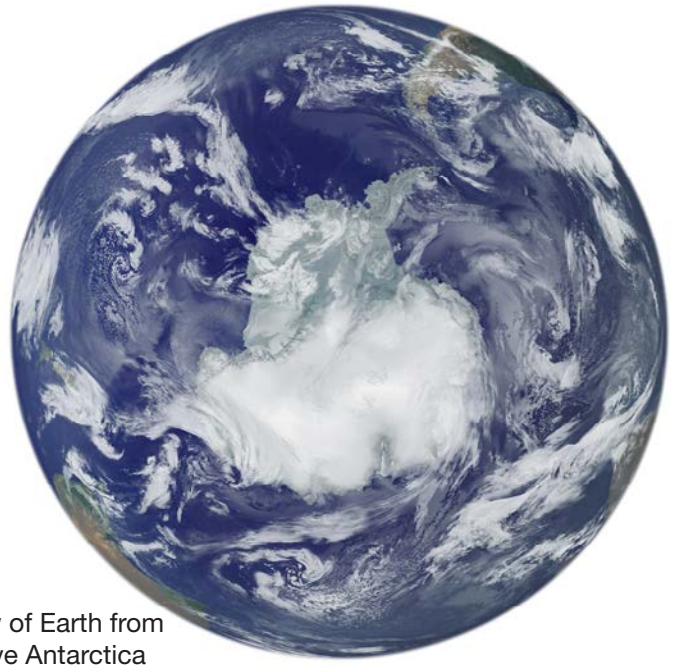
Introduction

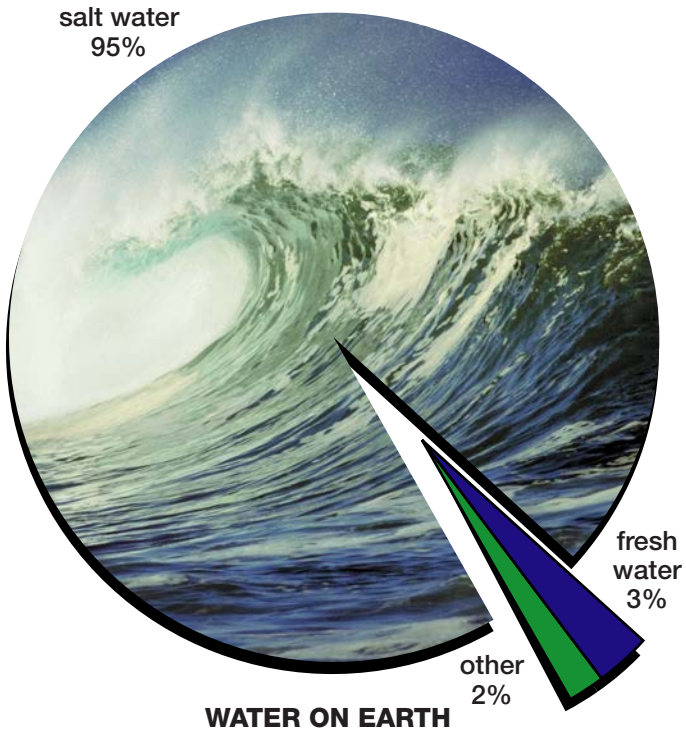
Water covers three-fourths of Earth's surface. Other planets have only traces of water or no water at all. This is why Earth is called the "water planet."

As the number of people on Earth increases, more water is used. More people also mean more pollution. Earth's fresh water becomes more and more precious.

In this book, you will learn about how Earth's water moves and changes. You will also learn how it is used and why it must be protected and conserved.



View of Earth from above Antarctica



WATER ON EARTH

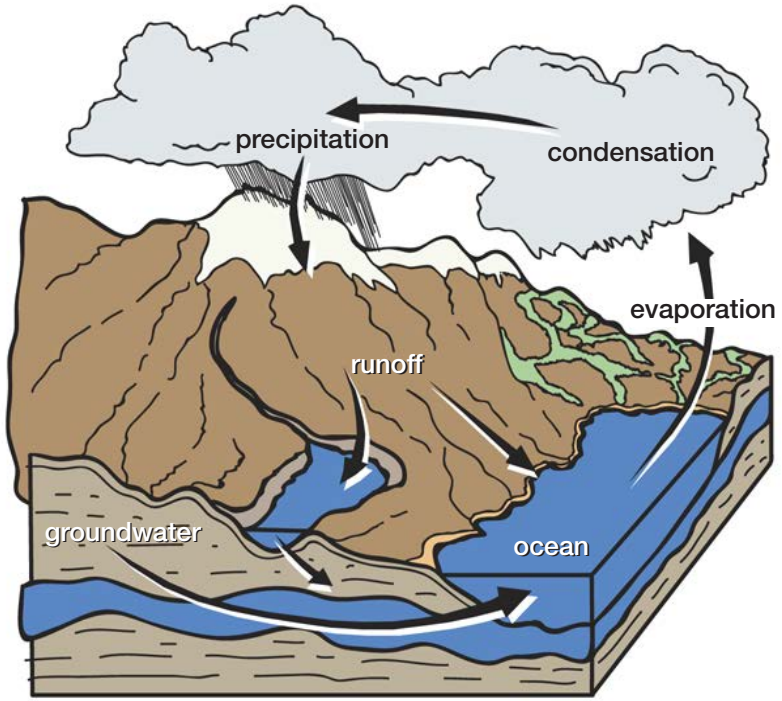
The majority of Earth's water is found in the oceans that cover most of Earth's surface. Ocean water has many minerals. These minerals make ocean water taste salty. For this reason, ocean water is called salt water.

The water that is not found in the oceans is called fresh water. Only 3 percent of Earth's water is fresh water. Fresh water is found in lakes, rivers, and streams. It is also found under the ground. Most of Earth's fresh water is ice. It is found around the North and South Poles in ice sheets and icebergs. It is also found in mountain glaciers.

The Movement of Water

Everything on Earth is made of matter. The three states of matter are solid, liquid, and gas. Most water on Earth is liquid. Some of it is solid ice, and some is a gas we can't see. That gas is called **water vapor**.

Earth's water moves in a cycle called the **water cycle**. As it moves from place to place, it changes from liquid to gas and gas to liquid. It also changes from liquid to solid and solid to liquid.



Water evaporates into the air, forms clouds, and precipitates down. On the ground, water flows downhill until it meets the ocean.

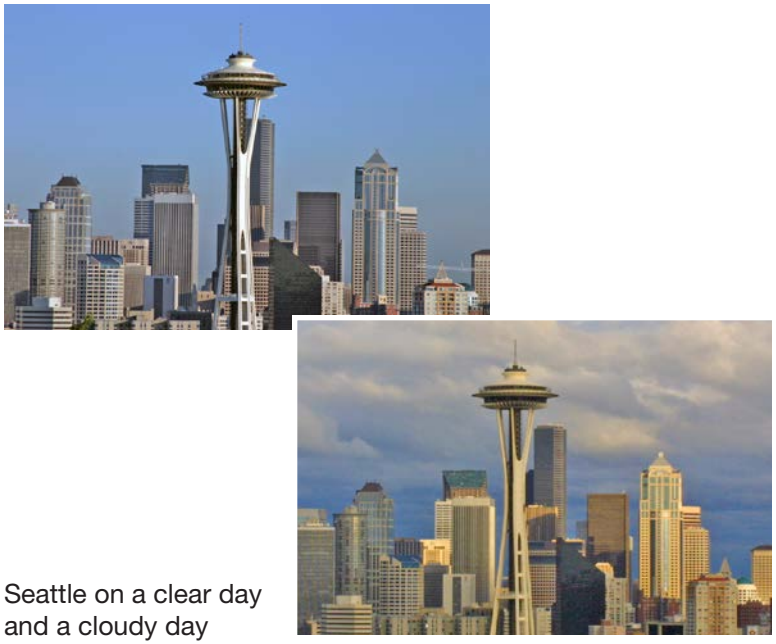
evaporation and condensation

Water needs energy to change from liquid to gas or from solid to liquid. The energy it needs comes from the Sun.

When water changes from liquid to water vapor, the process is called **evaporation**. This is the first step in the water cycle. Sunlight hits water on Earth's surface. Tiny particles that make up water, called **water molecules**, absorb some of the light energy and begin to move. As they get more energy from the Sun, they move even faster. When they get enough energy, they escape the liquid water and enter the air as water vapor.

When warm air near Earth's surface begins to rise, it cools. As the air cools, the water molecules in the air begin to slow down and lose energy. They collect on dust particles floating in the air. These molecules join other molecules and form tiny water droplets. As they lose energy, they change back to a liquid. This process is called **condensation**. That's the next step in the water cycle.

As more and more water droplets gather on dust particles, clouds begin to form. As more droplets form, the clouds get thicker and thicker. The clouds can get so thick that they form thick, dark storm clouds.



Seattle on a clear day and a cloudy day

Word Wise

Different clouds have different names. The names of clouds come from Latin words. Here are some Latin words that are used to name clouds.

cirro = high
cirrus = feathery
cumulus = fluffy
alto = mid-level
stratus = layers
nimbus = rain or snow

cumulonimbus:
large, fluffy rain clouds

nimbostratus:
thick layers of rain clouds

altocumulus:
mid-level fluffy clouds

cirrostratus:
high layers of clouds

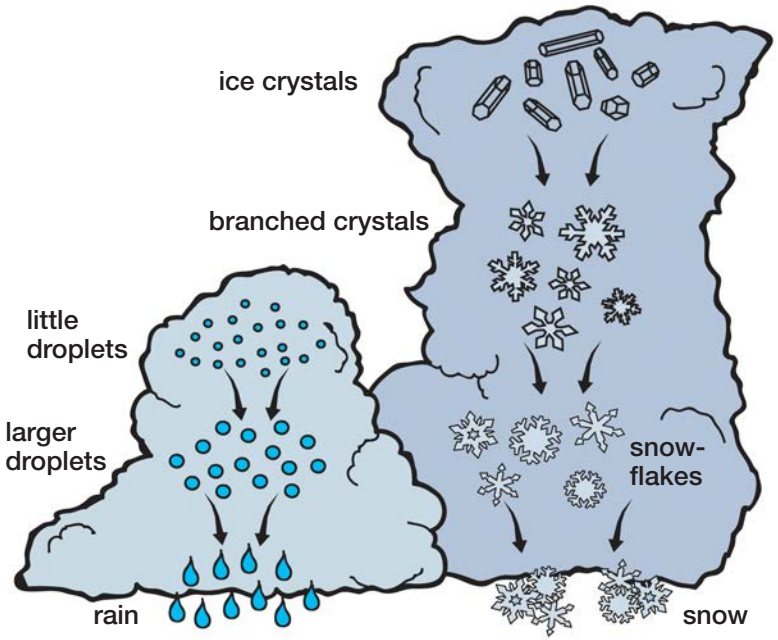
cirrus:
feathery clouds

Precipitation

Clouds can bring rain, snow, sleet, or hail. Each of these is a type of **precipitation**. That's the next step in the water cycle.

Rain forms when air inside a cloud gets cold and droplets get closer together. Little droplets join to make big droplets, and big droplets become raindrops. When they get too heavy to stay in the air, they fall to the ground as rain.

When the air in a cloud freezes, water droplets turn into ice crystals. These ice crystals join together and fall to Earth as snowflakes.

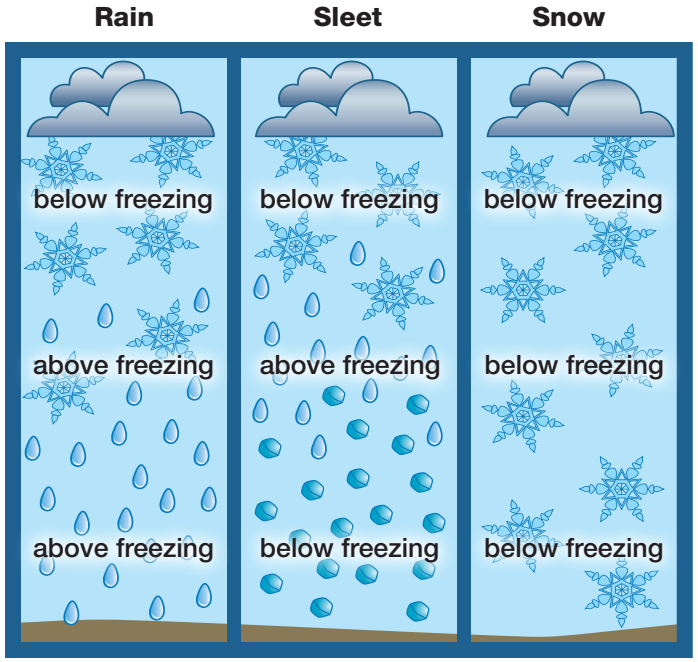


CONDITIONS FOR RAIN AND SNOW INSIDE A CLOUD

Precipitation can change after leaving a cloud. Sometimes rain freezes after leaving a cloud. Then it becomes sleet. This happens if the temperature beneath the cloud is below freezing.

At other times, snow melts on its way down to Earth and becomes rain. This happens if the temperature of the air beneath the cloud is above freezing.

If the temperature on the ground is freezing, rain will freeze after it falls from the clouds. Everything gets covered with ice. This is an ice storm.



The air temperature in and below the cloud, and above the ground, affects precipitation.

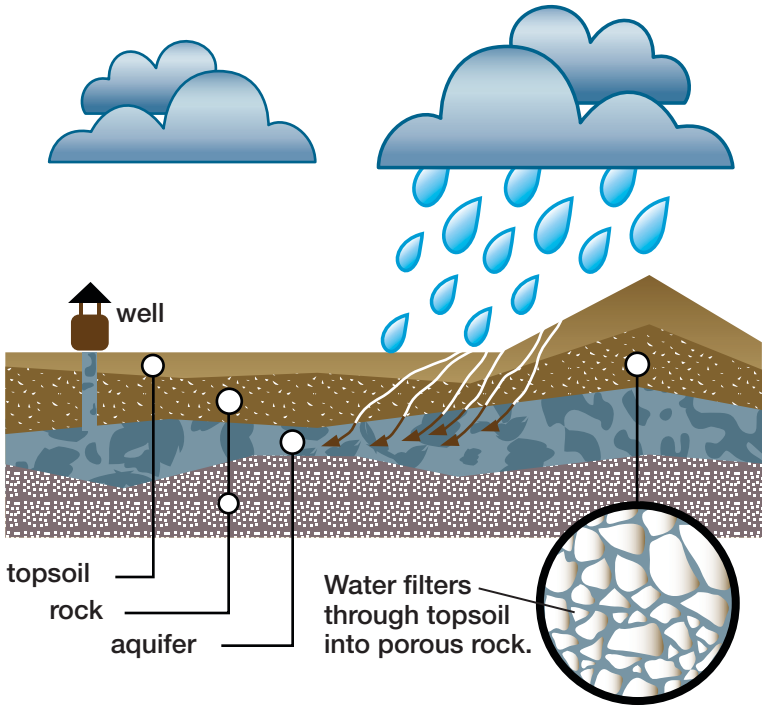
Water on the Ground

Most precipitation reaches the ground. When it does, it often flows over the ground or soaks into the ground.

Water flowing over the ground is **surface water**. Surface water flows from high land to low land, eventually flowing to the ocean. Since it runs off the land, it is called **runoff**. The area of land from which water runs off into streams and rivers is known as a **watershed.**

Water that soaks into the ground becomes **groundwater**. It travels through the tiny spaces between particles of rock, sand, and dirt. Underground areas where large amounts of groundwater collect are called **aquifers**.

Aerial view of water running off land into streams



Groundwater is an important source of fresh water for many people. Water wells are drilled into the ground to get fresh water for drinking and other uses. If water is taken out faster than rain and snow can replace it, wells can dry up.

Sometimes people dump harmful chemicals onto the ground. These chemicals can follow the same path as groundwater. The groundwater then becomes polluted. We must take steps to stop dumping harmful chemicals onto the ground. Once chemicals get into the groundwater, it is hard to get them out. This reduces Earth's supply of fresh water.

Erosion

Sometimes surface water moves across land with great speed and force. This fast-moving surface water has the power to wear away rock and soil. This process is called **erosion**. Eroded rock and soil often end up in rivers and streams.

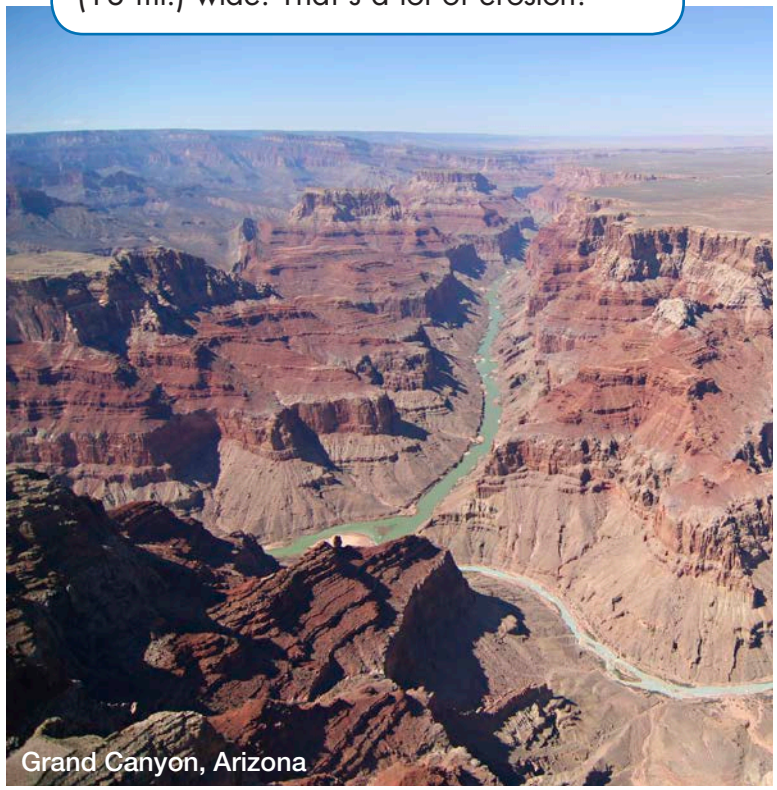
Farmers and foresters worry about erosion. It can remove valuable topsoil from land. Plowing fields and cutting and burning down trees expose the soil. Heavy rain can carry the soil away and dump it into rivers and streams.

The best protection against erosion is to keep plants growing in the ground. The roots of plants keep the soil tight. Planting crops across a hillside can help, too. Replacing trees that have been cut down also helps keep soil in place.


Erosion cuts away rock and soil.

WOWSER!

The Grand Canyon is over 1.6 kilometers (1 mi.) deep and up to 30 kilometers (18 mi.) wide. That's a lot of erosion!



Grand Canyon, Arizona

The Grand Canyon is a very deep and beautiful canyon. It was formed when fast-moving river water eroded soft layers of rock. Many of the world's canyons and valleys have formed in this same way. It took about a million years for the river to make the Grand Canyon. The river and runoff remove bits of rock and soil every day.

Deposition

The sand and soil, called **sediment**, are carried into streams and rivers by runoff. The river carries the sediment downstream. Wherever the moving water slows down, some of the sediment is deposited. This process is known as **deposition**.

Deposition of river sediment causes two kinds of land formations. When rivers bend and turn, the water slows down on the inside of the curve. Sediments are deposited along the inside bank to form a **sandbar**.

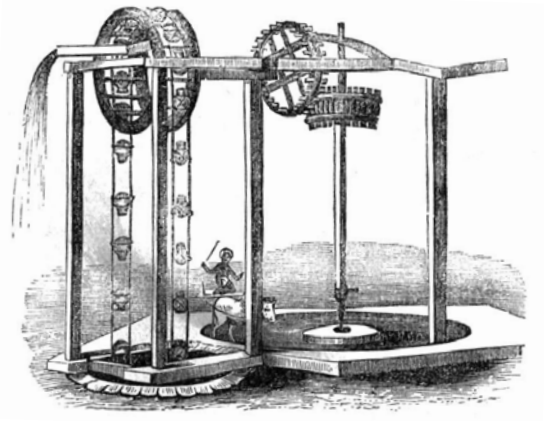
Rivers also slow down when they enter an ocean or large lake. Large deposits of sediment, called **deltas**, are found in these areas. Because deltas are made of rich topsoil, they make good farmland.

WOWSER!

The human body is about 60% water. There wouldn't be much of you left if the water evaporated.

the Nile Delta in Egypt

delta farmland



an ancient irrigation system

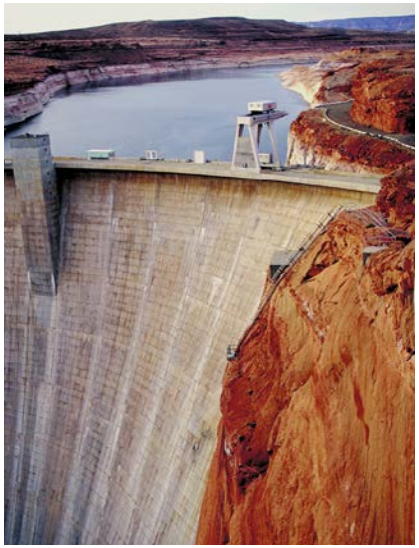
a modern irrigation system

Controlling Water

People need water. For years, they have settled in areas with plenty of water. Where there was not enough water, they built canals and ditches to bring water to them. They built dams and ponds to store water.

Farmers have built many kinds of irrigation systems to bring water to their crops. They have even used irrigation to grow crops in desert areas.

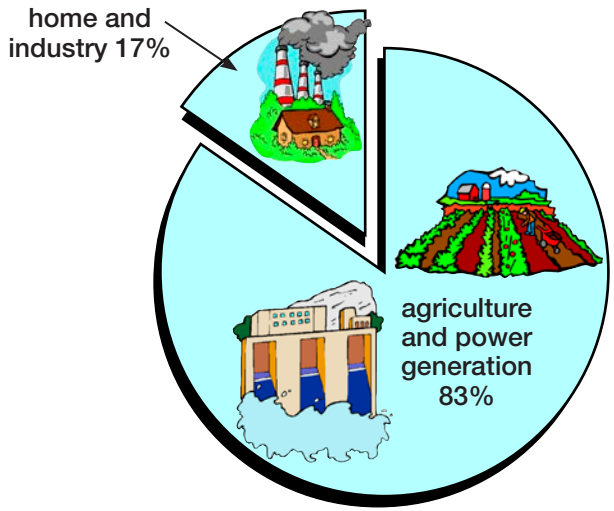
Modern dams that are hundreds of feet high have been built. They are used to prevent floods, to store water for use during drier times, and to make electricity. People have also put large pipes into the ground to carry water long distances.



Glen Canyon Dam at Lake Powell in Arizona

Water used in homes and factories is sent to sewage treatment plants. It is cleaned and then returned to the water cycle.

a water treatment plant



Water Uses

Most of Earth's fresh water is frozen in polar ice and mountain glaciers. Only about one percent is available for living things to use.

Fresh water is important for many reasons. The United States uses 40 percent of its fresh water to water crops. Industries use water for cooling things down and for cleaning things. People use large amounts of fresh water for drinking and bathing. They use it for cooking, cleaning, and watering plants, too.

In some parts of the world, clean water is hard to get. As the world's population continues to grow, fresh water becomes even more valuable.

Water Conservation

Where will our future fresh water come from? Some people are digging deeper wells to find more water. Other people are building factories that change salt water into fresh water. Water from these sources is more expensive than most fresh water today.

Scientists are discovering ways to conserve water. For example, they have invented toilets that use very little water. Some irrigation systems are now placed on timers. They deliver the right amount of water directly to each plant.

People can learn that our supply of fresh water is limited. We can learn how to conserve water.

Factories remove salt from salt water.

Things people can do to save water:

- Turn off the water when you're not using it.
- Don't run the water when you brush your teeth.
- Take shorter showers.
- Fix leaking faucets.
- Wash dishes and clothes only when you have a full load.
- Collect rainwater for plants.
- Water the lawn in the evening.
- Put lawn sprinklers on timers.
- Put in drip systems.

Conclusion

Without water, our planet would be a wasteland. Water and air are the most important resources for living things.

Water changes the way Earth looks. It forms rivers, lakes, and oceans. It builds valleys and canyons.

Water is constantly on the move. It changes states between liquid, gas, and solid. The water cycle brings us clouds and precipitation.

Water is a very important resource. We need to keep it clean, and we must not waste it.

Glossary

aquifer an underground layer of rock, sand, or other material through which groundwater flows (p. 12)

condensation the process by which water changes from a gas to a liquid state (p. 8)

delta a triangle-shaped area of land formed by sediment at the mouth of a river (p. 16)

deposition the act or process by which wind or water sets down sediment (p. 16)

erosion the gradual wearing away of rock or soil by water, wind, or ice (p. 14)

evaporation the change of water from a liquid state to a gas state, due to an increase in temperature (p. 7)

groundwater water held underground in soil or rock, often feeding springs and wells (p. 12)

precipitation water that falls from clouds in the form of rain, snow, sleet, or hail (p. 10)

runoff excess water, not absorbed by the soil, that flows downhill (p. 12)

sandbar a long ridge of sand formed in a body of water by currents or tides (p. 16)

sediment particles of dirt and rock that are carried by water, wind, or ice and deposited elsewhere (p. 16)

surface water water found above ground, on land (p. 12)

water cycle the path water takes, and the changes it goes through, as it cycles through the environment (p. 6)

water molecules a small particle of water, made up of hydrogen and oxygen (p. 7)

water vapor the gaseous state of water (p. 6)

watershed the area of land that catches rain and snowmelt when it flows as runoff (p. 12)

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