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What is the Environment? Why is it Important?

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What Is the Environment? Why Is It Important?

Air, water, **food** and shelter--these are the basic necessities of life. And they are provided for us by our planet Earth.

All of these things--our surroundings--are part of our "environment." The term "environment" is used to describe both the natural world, and our man-made surroundings. When we use it here, we will mean the natural environment.

Ecology

The study of how living things depend on each other and their environment is called ecology. Scientists who study ecology are called ecologists. Not only do they study animals and plants, but they also study humans in the environment.

The environment includes the air we breathe, the land and water that surround us and all the living things: plants, animals, insects, even bacteria. The environment also includes climate and location. A place can be warm and rainy or dry and hot. It can be near the ocean, in a forest or desert, or high up in the mountains. Your environment is not only the space immediately around you, but is as big as planet Earth itself.

Ecosystems and Niches

Organisms (living things) exist in many different kinds of environments. For example, polar bears live in the freezing cold of the Arctic, while certain bacteria live in hot springs at temperatures close to 100 degrees C, the boiling point of water. The kind of place where a plant or animal normally lives and grows is called its "habitat." Polar bears and the thermophilic ("ther-muh-fill-ik," meaning grows in high heat) bacteria live in very different habitats.

Many different kinds of animals live within each type of habitat. These animals live together in an interdependent group called a "community," just like people in a town or city are a community. The organisms in a community and all of their non-living surroundings are called an "ecosystem." An ecosystem can be as small as a rock pool on the beach, or as big as the Arctic.

The organisms that live within each ecosystem are perfectly adapted to survive there. Polar bears only live in the Arctic. Their thick, white fur keeps them warm and blends in with the snow. The bottoms of their broad feet are hairy, so they can walk on ice without slipping. Their **food** includes the seals, fish and birds that live there. They also eat plants that grow in the spring and early summer. Polar bears find everything they need to survive in their Arctic habitat.

Green turtles are adapted to a very different habitat. These large marine turtles live all around the world in tropical and subtropical oceans. They swim near the coastline, feeding on seaweed and algae. The females go ashore to lay their eggs in the warm sand. Their environment provides everything they need to survive.

Polar bears and green turtles live in very different environments, but like all other plants and animals, each is well adapted to its own habitat.

Every living thing fills an ecological "niche" within their ecosystem. This means that they don't simply take up space, but they have a function, or role to play in the community. For example, polar bears fill a niche in their Arctic ecosystem. They eat smaller animals, keeping the populations under control. Without the bears, the number of seals or birds might grow too large for the amount of **food** available to them. There are many different species of dung beetles, which feed on animal waste. In their niche, they perform a very important role in cleaning and maintaining their ecosystems.

Two different kinds of animals can not fill the same niche in the same ecosystem. For example, grey squirrels and red squirrels are very closely related. They usually live in the same type of woodland habitats, fill the same niches, and eat the same acorns, seeds and berries as **food**. Until the early 1900's, only red squirrels lived in the woods and forests of England. Then grey squirrels were brought over from America. Unfortunately for the red squirrels, there is only room in each niche for one type. The grey squirrels were more aggressive, eating the **food** and excluding the reds from the broad-leaf forests. The red squirrels had to find another niche to survive. They moved northward, where they were able to adapt to living in the evergreen forests found there.

Each ecosystem, and the plants and animals within it, exists in a delicate balance. Changing the environment, and adding or removing any part can upset that balance. The whole ecosystem could collapse. The survival of all living things on the planet, even humans, depends on maintaining a healthy ecosystem and keeping the balance of all of the living things within it.

Biomes--Different Kinds of Habitats

The main thing that controls the type of plants growing in any location is the climate. Climate is the normal weather conditions (temperature, precipitation, wind) over a long period of time. Since similar climates exist in many different places on Earth, similar habitats can be found in different locations.

These related areas across the globe are called "biomes." Scientists have not agreed on a single classification system for biomes, so you may see different types listed in other sources or references. One way to classify biomes is to split them into 5 different types: water (aquatic), desert, forest, grassland, and tundra. These 5 main types can each be split further. The aquatic biome has freshwater and marine biomes. The marine biome can be divided into estuaries, oceans and coral reefs. Forest biomes can be divided into temperate (seasonal), rainforest, and others.

In each type of biome, you will find similar kinds of organisms and ecosystems, no matter where on the planet it is found. For example, you can find bears not only in California forests, but also in Russian and Chinese woodlands.

The Earth's Natural Cycles

The planet Earth is always changing, and yet it maintains a delicate balance that supports all life here. Some of these changes, like the weather, can happen very quickly. Others, like the changing of the seasons, happen more slowly and on a regular and predictable basis. And still others, such as the climate changes of the Ice Ages, take thousands of years.

When the Earth's natural cycles change slowly over time, the plants and animals have to change too. This is a process known as adaptation. For example, the fur of the arctic fox thickens and turns white each winter to blend in better with its surroundings. If an area of the African tundra gradually

becomes drier over several years, the animals learn to look elsewhere for water. Given enough time, they may be able to find other sources of water, or they may move to a wetter location.

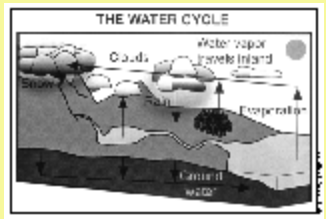
On the other hand, if a change in these natural cycles is very sudden or drastic then the animals and plants that relied on a regular pattern might not have time to adapt, and may not survive as a consequence. Floods and droughts are examples of the type of sudden natural change in environment that can be disastrous to the living things within it. These changes are often simply part of a natural cycle, but sometimes people affect and alter the environment in harmful ways.

In addition to these types of changes, there are a number of continuous cycles which support and maintain life. The air, water and all living things are part of one huge ecosystem, each piece dependent on all of the other parts.

The Water Cycle

The Earth's water is constantly on the move in a continuous cycle. In fact, the water you drink today may be the same water a dinosaur drank! Every river and stream, every ocean, lake and puddle, contains droplets of water that have circulated, or recycled around the planet for billions of years.

The cycle starts when water evaporates from the oceans, lakes and rivers. Heat from the Sun turns the liquid water into water vapor that rises up into the air. When the water vapor reaches the cooler layers high in the atmosphere, it condenses into tiny water droplets and forms clouds.



Water Cycle

(See picture, "Water Cycle.")

Winds in the atmosphere push the clouds along. The tiny droplets grow, and eventually fall as rain, snow or hail, often many hundreds of miles away from where the cloud was formed. Some of this water soaks into the ground where it flows into "aquifers," underground layers of permeable rock, sand or gravel. Some makes its way into streams and ponds, flowing into lakes and rivers, and back to the sea. Anywhere along the way, the water may evaporate and the cycle starts over again.

All animals need water to survive, but clean, fresh water is a limited resource. The majority of water on the planet's surface, in the form of oceans and seas, is salt water. Only around 1% of the Earth's water is fresh liquid water.

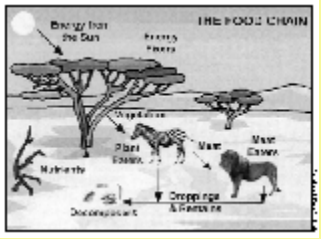
In many places, people get their water directly from lakes or rivers. Surface water is often diverted into human-made reservoirs for storage and use. In some areas, people use wells to get fresh water from the underground aquifers. No matter where your drinking water comes from, you can see how important it is to protect our limited sources of fresh, clean water.

The Food Chain

We mentioned earlier how all living things on the planet interact and depend on each other. A good example of that is the **food chain**.

The **food chain** begins with energy from the sun. Plants use this energy, along with carbon dioxide (CO_2) from the air, and water and nutrients from the soil, to produce everything they need to live and grow. Green plants are called the "energy fixers." Using a series of chemical reactions called photosynthesis, plants turn water and carbon dioxide into simple sugars. The sugars store energy for later use. They are also used as building blocks for more complex molecules, such as other carbohydrates, proteins, fats and cellulose (a structural material in plant cell walls).

(See picture, "**Food Chain**.")



Food Chain

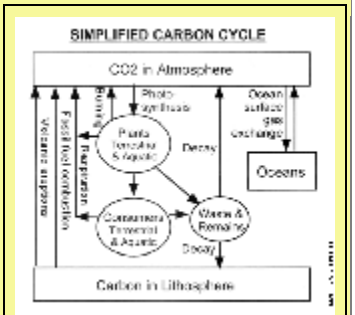
Plants also provide **food** for animals. Herbivores are animals that eat vegetation, but not meat. Examples are rabbits and other small rodents, some insects, certain birds, and ruminant animals such as sheep and cows. The herbivores themselves may become **food** if eaten by carnivores or omnivores. Carnivores are strictly meat eaters, while omnivores eat both plants and animals. Cats, foxes and birds of prey are carnivorous. Most humans are omnivores, although some, called vegetarians, are herbivores.

Nothing in the **food chain** is wasted. When plants and animals die, the remains are recycled by the "decomposers." The decomposition process often begins with worms and certain insects (beetles and grubs), and is then completed by fungi and bacteria in the soil. The decomposers break down the dead material, and the waste products that all animals produce. They take what they need to live, and the rest is returned as nutrients to the soil. New generations of plants will use those nutrients to grow, starting the cycle all over again.

The Carbon Cycle

Carbon is one of the most common elements in the universe. It is the building block of life here on Earth. Even though carbon makes up only a small fraction of the Earth's total mass (about 0.001%), the human body is about 18% carbon.

Carbon is found in the atmosphere, oceans, soil, rocks and the planet's interior, as well as in all living things. It moves from place to place in two natural cycles, the geological and the biological-physical carbon cycles.



Carbon Cycle

(See picture, "Carbon Cycle.")

Our planet is constantly changing, and the geological carbon cycle operates over millions of years. Carbon dioxide in the atmosphere reacts with minerals in rocks and soil to form carbon-containing chemicals, called carbonates. Through weathering and erosion, these carbonates are washed away to the ocean where they settle on the bottom.

The surface of the planet is not solid, but is covered in "tectonic plates" that fit together like a jigsaw puzzle. These plates move very slowly over time. In some areas of the ocean floor, the plates are moving apart. Molten rock flows up through the cracks, then cools to form new ocean floor. Where two plates come together, one of the plates slides under the other, returning surface material to the interior of the planet. This is called "subduction."

The carbonates, as part of the seabed, are returned to the planet's interior through subduction. There, the material melts and more reactions take place, forming carbon dioxide. The carbon dioxide gas is returned to the atmosphere when volcanoes erupt.

The Biological Carbon Cycle: Respiration & Photosynthesis

In the earlier section on the **food chain**, we discussed photosynthesis. It turns out that this process is also part of the carbon cycle. Plants take in atmospheric carbon dioxide and produce sugar and **food**. The reactions which occur during photosynthesis release oxygen back into the air. Humans and

animals need this oxygen (O_2) to live. Land animals get their oxygen from the air they breathe. Most aquatic animals absorb oxygen from the water in which they live.

The oxygen is used in reactions which provide our bodies with energy. During those reactions, the oxygen is converted to carbon dioxide (CO_2). Exhaled as a waste gas, this CO_2 is returned to the atmosphere. This process of taking in and using oxygen and exhaling carbon dioxide waste is called "respiration." The exhaled CO_2 is available for plants to use, starting the cycle over again.

There are also other sources of carbon in the biological carbon cycle. Carbon that makes up the plants and bodies of animals is released after death by decomposition. Forest fires, and burning wood or fossil fuels, release carbon dioxide into the air. Even the oceans play a role, absorbing and holding large amounts of dissolved carbon dioxide.

So, animals and plants depend on each other for survival. The "waste" gases from plants keep animals alive and the "waste" gases from animals keep plants alive.

The balance between how much $C0_2$ is produced and how much is reabsorbed is essential to all living things. If this is altered, either by a change in natural cycles or because of humankind's influence, the consequences could be disastrous.

We All Need Each Other

All of the planet's natural cycles are interlinked. For example, the CO_2 cycle depends on photosynthesis from plants and respiration from animals, which also require water from the water cycle. Both CO_2 and water are also part of the **food** cycle. Changes in any one of these cycles will therefore have an effect on all of the Earth's dynamic systems. A healthy balance within each is vital for the health of the entire planet and all of the living things it supports through these natural cycles!