Title:	The Water Cycle and Water Conservation
Source:	The Magnificent Groundwater Connection, U.S. Environmental Protection Agency
Subject(s):	Science, Language Arts
Grade(s):	6-8
Objectives:	Students will read about the fundamental concepts behind water distribution, water use and water conservation.
Summary:	This article is an introduction to the key concepts of water distribution on Earth, water use and water conservation. The fundamental steps of the water (hydrologic) cycle are also discussed. A list of key terms is provided at the end of the article for review.
Extension:	Students may select and research a water-related topic presented in this article and write their own brief articles. All of the articles may be compiled into a class "newspaper" to be used as a review sheet or to share what they have learned with other classes. Topics could include: the Clean Water Act, drought, water pollution, water reuse, flooding, water purification in nature, or the water treatment process.
Standards:	S6CS10. S7CS10. S8CS10. Students will enhance reading in all curriculum areas. S6E3. Students will recognize the significant role of water in earth processes. ELA6R2. ELA7R2. ELA8R2. The student understands and acquires new vocabulary and uses it correctly in reading and writing. ELA6RC4. ELA7RC4. ELA8RC4. The student establishes a context for information acquired by reading across subject areas.

Getting Up to Speed

The Water Cycle and Water Conservation

The Water We've Got Is The Water We've Got

The water available to planet Earth is the same water that has always been available and the only water that ever will be available. Because water covers three-quarters of the earth's surface, it might appear that there is plenty to go around. In reality, however, we have a limited amount of usable fresh water.

Over 97 percent of the earth's water is found in the oceans as salt water. About two percent of the earth's water is stored in glaciers, ice caps, and snowy mountain ranges. That leaves only 1 percent of fresh water that is readily available to us for our daily water supply needs. Our fresh water supplies are stored either beneath the ground, in soil or fractured bedrock, or in surface waters, such as lakes, rivers, and streams.

We use fresh water for a variety of purposes. Nationally, agricultural uses represent the largest consumer of fresh water, about 42 percent. Approximately 39 percent of our fresh water is used for the production of electricity; 11 percent is used in urban and rural homes, offices, and hotels; and the remaining 8 percent is used in manufacturing and mining activities.*

The Never-Ending Journey

If you think about it, water never stays in one place for too long. Water is always on the move, traveling on a never-ending, cyclical journey between earth and sky. This journey is referred to as the **water cycle**, or **hydrologic cycle**. During its journey, water is continuously reused and recycled. It also changes form. It falls to the earth as rain, snow, sleet, or hail and **evaporates** from the earth back into the atmosphere as water vapor.

What form water takes and where it goes once it reaches the earth depends on where it lands. It might seep into the ground and move along slowly with the ground water to a nearby lake, stream, or estuary. It might sink into the ground, be taken up by a plant, move through the plant to its leaves, and evaporate back into the atmosphere (**transpiration**). It might land on a lake or pond and spend a season or two freezing and thawing—that is, changing from liquid to solid, and vice versa. It might land on a river or stream and continue on to the ocean. It might be heated by the sun, evaporate into the atmosphere, condense into tiny droplets, and become part of a cloud formation. Eventually, the water in the cloud falls back to the earth, and the journey begins again.

The People Connection

While the total amount of water on earth remains constant, the availability of that water changes with weather (for example, drought or flooding), season, and human use. This problem is made worse in situations where communities use water from one location but release it into another place after it is used. In Massachusetts, for example, many communities in the Boston metropolitan area drink water from the Wachusett, Ware, and Quabbin Reservoirs located in central and western Massachusetts, but discharge that water as wastewater into Boston Harbor.

* Water use statistics from the "National Water Summary 1987—Hydrologic Events and Water Supply and Use." U.S. Geological Survey Water Supply Paper 2350.

If we understand that we have all the water that we will ever have, we can better appreciate why it is so important that we keep our water clean. The fresh water that is available for use by people, plants, and animals must be clean. And to this end, nature is very accommodating. The water that circulates between the earth and the atmosphere is continually restored and recycled thanks to Mother Nature's impressive bag of biological, chemical, and mechanical tricks.

But sometimes human carelessness bogs down the system, loading harmful and unhealthy substances into the system at a rate that exceeds its natural restorative capabilities. When harmful substances are discarded into the environment, they may very well end up as part of the water cycle. Nature can also stir up some environmental problems as a result of natural events such as volcanoes, earthquakes, and tornadoes.

When chemicals are released into the air from smokestacks, for example, they might well return to the earth with rain and snow or by simply settling. When harmful substances are discarded onto the land or buried in the ground, they might well find their way into ground water or surface water, which may, in turn, be someone's or some community's drinking water. In nature's water cycle, all things are connected.

In many ways, we, as a society, have had to learn about managing and caring for our water resources the hard way. By the early 1970s, many of our nation's water supplies had become foul-smelling and unhealthful. In 1972, recognizing that we could no longer turn our collective backs on the problem, Congress passed the **Clean Water Act**, thereby setting in motion the beginning of a concerted effort to rehabilitate the nation's degraded waters. Taking our cues from Mother Nature, we have over relatively few years developed biological, chemical, and mechanical technologies that effectively clean wastewater before it is discharged into waterbodies.

Keeping water clean is not just our nation's problem; it is a worldwide problem. Many other nations are trying to manage their water resources. Preventing water quality degradation from occurring in the first place is certainly the most cost-effective approach to water quality management. The water quality in some areas of the world has deteriorated to such an extent that the cost of turning the problem around has become prohibitive.

WHY CONSERVE WATER?

The issue of water conservation is not about "saving" water—it is about having enough clean water at any given time and place to meet our needs. Gifford Pinchot, an American conservationist and politician who served as chief of the U.S. Forest Service between 1898 and 1910, referred to **conservation** as "The wise use of the earth and its resources for the lasting good of men." The conservation of our water resources depends on our wise use of these resources. Such wise use, without a doubt, begins at home and in our community.

As we attempt to meet the water use needs of a growing population, issues of water quality and quantity will gain increasing significance in years to come. We cannot afford to take our water resources for granted—not even here in the water-rich Northeast. Droughts, for example, are natural occurrences that can cause water shortages.

But human activities can cause water availability problems as well. In some instances, communities have had to seek other sources of drinking water because their water supply well had been contaminated. For example, infiltration of gasoline from a leaking underground storage tank into a ground water supply well is all it can take to render a well field unusable. Once ground water becomes contaminated, it can take years or decades for it to clean itself naturally.

To some extent, we all share responsibility for ensuring the availability of a clean and healthy water supply. We can try to reduce contamination by keeping the water, the ground, and the air free of pollutants as much as possible. We can use just the amount of water that we need.

Industries can recycle their process water or pre-treat their wastewater so that it is easier to purify for drinking water and other purposes. Communities can educate residents about local water resources and work together to implement land use strategies that will protect and sustain water supplies into the future. They can develop plans to handle water shortages without waiting for a water emergency and can help residents dispose of harmful products properly by offering hazardous waste collection days. By behaving responsibly in our use of water, we can be sure that there will be enough clean water when we need it.

It is only recently that environmental issues and our interrelationship with the natural world have been integrated into school curricula. In this sense, teachers and students have become our environmental educators, getting the word out to families and friends that we all share the responsibility for protecting and maintaining our earth for current and future generations. This resource book is designed to help students recognize their own ability to make a difference in conserving and protecting our water resources.

KEY TERMS

- **Clean Water Act**
- **Conservation**
- **Evaporation**
- **Hydrologic Cycle**
- **Transpiration**
- **Water Cycle**