

Water and Science

Overview

Earth Sciences

The water cycle is a closed system – all of the water that exists on the earth today existed when the planet was first formed. Of all of the water on the earth, only about 1% is freshwater that is readily available for human use. Saltwater makes up 97% of the Earth's water and the other 2% is freshwater that is trapped in glaciers, snow or permafrost, or deep underground in aquifers. Due to population increase, demand for water is increasing and we are using water at a rate our water supply cannot sustain. Climate change is also currently affecting Earth's water supply by melting glaciers thus causing sea levels to rise as well as changing climate and weather patterns. These changes are having major impacts on human life – including drought, flooding, and an increase in natural disasters such as hurricanes, landslides, or cyclones.

- The number and types of organisms an ecosystem can support depends on resources available. How does our dwindling freshwater availability affect our ecosystem? How does this affect lives around the world?
- How does water shape our landscape (rivers, streams, waves, floods)? What ways have we (humans) changed the flow of water and thus the landscape?
- Study recent earthquakes/tsunamis and explore the role of plate tectonics and their effects on people's lives.
- Identify renewable and nonrenewable resources. Discuss where water fits into these categories. What does nonrenewable resource mean in terms of amounts, distribution, usefulness, and time required for formation (water cycle)?
- Discuss the effects of the sun's heating of the earth's surface have in reference to natural disasters. Explore possible methods to avoid such disasters.
 - Discuss the effects of climate change with attention to the melting of ice caps and rising sea waters. What consequences do such effects have?
- Study the Water Cycle. Trace where our water comes from, how we contaminate it and what contaminating our water supply means for the future.

Life Sciences

Humans are part of ecosystems. Ecosystems have limited resources and can only support a certain amount of impact. Humans can impact environments and ecosystems through population growth, urbanization, consumption, pollution, technology, and more. These have direct impacts on limited resources, like the water supply, in an ecosystem. Although water is a renewable resource, humans consume more than can be replenished. A lack of water not only puts a strain on human life, but plant and animal life as well. Currently worldwide, people are forced to adapt to changing climates and weather patterns affecting all parts of their lifestyle such as farming, lifestyle, health, etc.

- Without available drinking water what happens to biodiversity? How does this affect humans?

- How has climate affected the distribution of past and present organisms? How is water affected by climate change and what effect does it have on organism distribution? For example, what effects do melting ice caps have on humans?
- Explore the effects of the following on our ecosystem: biodiversity, changes from climate and human activity, population fluctuations, stability, food web, heat release.
- What are the problems associated with drinking unclean water. Identify where these issues are greatest and why these places are most affected.
- What happens when humans contaminate water supplies? What are the most common waterborne diseases? How many people die each year due to water-related issues?
- What parts of the world are most susceptible to waterborne disease? What are some ways to prevent waterborne disease?
- What are the many ways that water sources can get polluted? What effect does agriculture and farming have on the land and ecosystem? Explore advances in farming like irrigation systems and crop rotation. What are some ways that farmers can reduce water use and utilize land resources better?
- What are the effects of over fishing? Who is affected? Who is over fishing?
- What are the effects of deforestation? What happens to the soil's ability to retain water when trees are removed?
- What are the effects of urbanization on the water system?

Physical Sciences

Water is a renewable source that is becoming increasingly scarce due to population increase, overuse and overconsumption. People use water in a variety of ways everyday including drinking, washing, farming, recreation, and even energy. Hydropower is a popular energy source that has been utilized for centuries – it represents 19% of the world's electricity production. The energy from water currents or waves is harnessed into mechanical energy or electricity.

- Why is water so crucial for us and all animal and plant life?
- Distinguish the difference between renewable and nonrenewable resources. Discuss where water fits into these two categories.
- How can a renewable resource like water run out? What are the consequences of overuse?
- Explore how water can be used as an energy source? Investigate impact of water energy on humans and on the environment. Is hydropower an effective source of energy? What are the main arguments in favor and against hydropower?
- Explore how dams work to control the flow of water, as well as their role in hydroelectric power. What are the costs and benefits of dams?
- How does desalination work? How is the salt separated from the water? Identify the costs and benefits of desalination? Who is benefiting? Who is losing?
- When water is contaminated, what are some ways it can be filtered and cleaned? How do water filtration systems work?
- How do water treatment plants work? How can wastewater be reused?

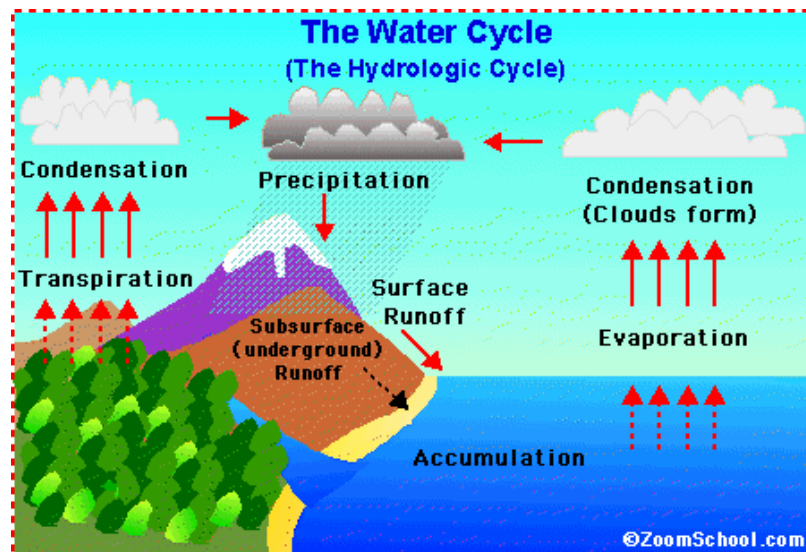
Nature of Science

Scientific knowledge and inquiry

- Investigate a science-based societal issue, such as pollution and water; disease and water; scarcity and water; etc. Research the literature, analyze data, and communicate the findings.

Possible Topics

- Compare and contrast the driving force behind two dams (i.e. 3 Gorges, Aswan) the costs and benefits environmentally, socially, politically, economically, etc.
- Explore countries where rising sea levels are or will be affecting its population (i.e. Tuvalu, Bangladesh, etc.)
- Explore polluted water sources around the world (i.e. Ganges in India). Follow the river and track the pollution and its effects on the ecosystems it flows through.
- Explore some scientific innovations addressing water shortages/pollution/flooding etc. (i.e. drought resistant wheat in Australia)



Lesson Plans

Flood! Learn about how and why soils have different capacities for retaining water, discuss ways to manage flooding, and explore human settlements near major rivers.

<http://school.discoveryeducation.com/lessonplans/programs/flood/>

Pollution Solutions: Learn about how water systems get polluted and think of ways to clean them up. <http://school.discoveryeducation.com/lessonplans/programs/finiteoceans/>

Earth's Waters: Learn about how water affects humans and vice versa.

<http://school.discoveryeducation.com/lessonplans/programs/earthswaters/>

Contaminants in the Water Cycle: Students will review the water cycle and investigate how a region's water supply can become contaminated. They will look at a list of the Environmental Protection Agency's maximum contaminant levels for drinking water, and sketch the water cycle of a fictitious town that is affected by several pollutants.



<http://www.nationalgeographic.com/resources/ngo/education/xpeditions/lessons/14/g912/tgsouhegan.html>

Thinkfinity: Free lesson plans and educational resources. Search by grade level, subject or keyword. Includes lessons and resources from Xpeditions, EconEdLink, Science NetLinks, and more. <http://www.thinkfinity.org/>

Online Resources

World Health Organization (WHO): <http://www.who.int/topics/water/en/>

General information, fact sheets, multimedia, statistics, and more on health and water.

International Year of Sanitation: <http://esa.un.org/iys/>

To put the spotlight on sanitation the UN General Assembly declared the year 2008 the International Year of Sanitation. The goal is to raise awareness and to accelerate progress towards the Millennium Development Goal (MDG) target to reduce by half the proportion of the 2,6 billion people without access to basic sanitation by 2015.

The Water Cycle: http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

From the Environmental Protection Agency (EPA), an interactive illustration of the water cycle. This site also has various resources for students and teachers to learn about water – go to <http://www.epa.gov/safewater/kids/index.html> to explore the additional resources.

U.S. Geological Survey: Water Science for Schools: <http://ga.water.usgs.gov/edu/mwater.html>

Statistics, graphs, and general information about water, including the water cycle, hydroelectric power, water's chemical properties, water quality, and the effects of urbanization on the water system.

World Commission on Dams: <http://www.unep.org/dams/WCD/>

Brokered by the World Bank and the World Conservation Union (IUCN), the World Commission on Dams (WCD) was established in May 1998 in response to the escalating local and international controversies over large dams.

Building Big: All About Dams: <http://www.pbs.org/wgbh/buildingbig/dam/index.html>

From PBS – Learn about dams – how they are built, why certain shapes are used, how they work, the controversies surrounding them, and explore some of the world's largest dams.

UNICEF: Voices of Youth: http://www.unicef.org/voy/explore/wes/explore_wes.php

Voices of Youth is an Internet site created by the United Nations Children's Fund (UNICEF) for young people who want to know more, do more and say more about the world. This section has resources on water, environment and sanitation. Check out the fact sheets, Water Alert! game, and much more.

Quest: <http://www.kqed.org/quest/>



A KQED Multimedia Series Exploring Northern California Science, Environment and Nature. QUEST for Educators offers free, standards-based resources to help your curriculum come to life with real-world connections using QUEST media. Here are some suggested resources to check out:

Water Pollution Educator Guide

http://www.kqed.org/quest/files/download/63/Radio2_28WaterPollution.pdf

State of Thirst: California's Water Future

http://www.kqed.org/quest/files/download/74/209a_StateofThirst.pdf

Global Warming and Water Educator Guide

http://www.kqed.org/quest/files/download/58/210b_ClimateChangeandWater.pdf

Videos

The Power of Water – 6 min

<http://video.nytimes.com/video/2008/09/23/business/1194820732727/the-power-of-water.html?scp=7&sq=water&st=cse>

The ocean power industry has made few advances compared to the wind and solar power industries. But the colossal power of the ocean continues to attract companies around the world.

A Simple Solution for Clean Water – 2 min

<http://video.nytimes.com/video/2006/10/06/science/1194817112055/a-simple-solution-for-clean-water.html?scp=3&sq=water&st=cse>

Donald G. McNeil Jr. demonstrates how a new personal water filter, worn around the neck, could help ensure people around the world have clean water to drink.

Tuvalu: That Sinking Feeling – 16min

http://www.pbs.org/frontlineworld/rough/2005/12/tuvalu_that_sin_1.html

There's trouble in paradise. A small island nation in the South Pacific, Tuvalu, is threatened by rising ocean levels believed to be caused by global warming.

Africa and Asia: Living on the Edge – 16 min

http://www.pbs.org/frontlineworld/stories/africa705/video/video_index.html

Exploration of the effects of climate change and other factors in Asia and Africa (base of the Himalayas, Kenya and Namibia)

Water: Drop for Life

<http://www.un.org/waterforlifedecade/index.html>

Watch the 'Water, Drop of Life' Video of the Decade and discover the issue (*located on in the middle-right side of page*).

Rx for Survival

<http://www.pbs.org/wgbh/rxforsurvival/series/video/index.html>



World Savvy

A PBS series about global health that explores past innovations in health, as well as current global health issues and their solutions. Watch various segments from the series, many dealing with water-related diseases such as River Blindness, Dehydration, and Malaria.

Food & Water Watch Library

<http://www.foodandwaterwatch.org/water/films/library>

A great selection of water-related films available on loan from Food & Water Watch.

Current Event Articles

Water Helps Niger's 'Onion Mafia'

<http://news.bbc.co.uk/2/hi/africa/2865495.stm>

A new black market has sprung up in Ivory Coast for Niger's onions.

A Tall, Cool Drink of...Sewage?

<http://www.nytimes.com/2008/08/10/magazine/10wastewater-t.html?pagewanted=1&th&emc=th>

Exploring how wastewater can be treated and turned into drinking water

Bangladesh: Dhaka's Dying River Threaten Residents

<http://www.irinnews.org/Report.aspx?ReportId=85246>

Severe pollution is rendering the rivers around the capital, Dhaka, biologically dead, with specialists warning the situation is beyond rescuing.

Concerns Rise with Water of Three Gorges Dam

<http://www.npr.org/templates/story/story.php?storyId=17723829>

As a massive Chinese reservoir is filled to capacity, concerns resurface about the project's impact on the environment, resettled residents and the region's cultural heritage.

Smart tech could save billions of liters of water

<http://www.reuters.com/article/environmentNews/idUSTRE56L4ZV20090722>

How better technology and innovation can help reduce our water use through irrigation systems and reduced energy use.