

Virtual Team Challenge: Spill!
Supplemental Curriculum

Environmental Awareness Handout #1

The Earth's Water System

In New City, an oil spill has occurred, threatening to contaminate the local water supply. Understanding the steps in the water cycle will help the City recover completely from the crisis.

Water: A Balancing Act

All life on earth depends on water. Plant life needs water to photosynthesize energy. Animal life needs water for hydration – and otherwise rely on water-dependent plants and animals for their food supply. The water that life on earth relies on comes in many forms. Water can be gaseous ‘vapor’ form, liquid form, and frozen as ice.

Nearly all (about 97%) of the Earth's solid water is sea water contained in the oceans. The remaining 3% is ‘fresh water’ which is used for irrigating crops, for industry, and as drinking water once it’s treated. About two-thirds of the earth’s fresh water is trapped in frozen glaciers at its poles – and the remainder runs deep underground, and also flows over-ground through earth’s lakes and rivers.

Earth is a *closed system*, which means that it does not gain much matter from, nor lose much matter to, outer space - including water. That means that most of the water on earth has been since eons before humans formed prehistoric society. Thanks to the water cycle, however, the same water is continuously reused by the earth in what is known as a *water cycle*.

Understanding the Water Cycle

The water cycle is vital for making sure rain falls around the world. People depend on the water cycle for drinking water for themselves, for their animals, and also for growing food. Lack of rain affects many parts of the world causing droughts – which ultimately lead famine and may cause as many as 80,000 deaths per year.

Also, as earth recycles water through its water cycle, many human and natural activities cause *water contamination*. Because a sizeable amount of fresh water is locked away as ice sheets and glaciers, there is only a small proportion which travels through the water cycle –which means we have to take care to ensure that human activities *contaminate* the water supply as little as possible.

Steps in the Water Cycle

- 1) *The first stage of the water cycle is when moisture from the sea and plants is lifted into the **atmosphere**. As the sun beats down it warms the oceans, rivers and lakes. This causes the water to rise into the air as water vapor. This process is known as **evaporation**. A tiny amount of moisture is also released from trees and plants. This is known as **transpiration**.*
- 2) *As the water vapor rises in the atmosphere, it cools and condenses, forming clouds. This process is known as **condensation**. It is the same process that makes you see your breath on a cold winter morning. The clouds will then produce rain or snow (known as **precipitation**) which returns to the Earth's surface as water. The cycle then starts all over again.*
- 3) *Only about three quarters of rain-fall on earth lands in its oceans. This is much less than leaves in the first place. The remaining water makes only a slow return to the oceans. Most is locked up in glaciers and icebergs and can take several thousands of years to complete its cycle. In tropical areas the process can take just a few hours.*
- 4) *The remaining water runs slowly over-ground, seeps into the ground or is taken up by plants as the cycle begins again.*

Virtual Team Challenge: Spill!
Supplemental Curriculum

Environmental Awareness Handout #2

Personal Responsibility and Earth's Water Systems

In New City or the real world, the decisions we make about how we use water have an impact on the planet – and on future generations.

Taking Care of Water

Less than 1 percent of all water earth's is available for human consumption; the rest is salty ocean water, or freshwater that is bound up in glaciers and polar ice caps. Only a tiny percentage of the water available is used as drinking water. Most freshwater used to create electricity, grow crops, run factories, and for household and sanitation needs. Water is in demand for a myriad of uses: recreational, mining and industry, fishing, irrigation, and riparian habitat preservation, among others. In the U.S., almost 100 gallons per day of drinking water are used per capita.

So What's the Problem?

In the last 100 years, human water consumption has shot up nearly ten times over. As we begin the 21th century, many parts of the world have reached, or are about to reach the limits of their supplies. And, while water supplies dwindle, population is soaring. According to a United Nations study, "two out of every three people on earth will suffer moderate to severe water shortages in little more than two decades from now. Globally, one in six people still have no regular access to safe drinking water, and more than twice that number (2.4 billion people) will lack access to adequate sanitation facilities."

The water supply problems we face, however, are not far in the future or far away from home: In the American Southwest, lack of rainfall, low levels of water stores, and a mushrooming population is pushing the limits of their water supply. In fact, the Department of the Interior now concedes that "today, in some areas of the West, existing water supplies are, or will be, inadequate to meet the water demands of people, cities, farms, and the environment even under normal water supply conditions."

Excessive use of water has the following adverse effects on our society, economy, and environment:

- *Dams must be built to meet demand.* This can destroy some wilderness areas and reduce water flows to others – resulting in the permanent loss of our green spaces.
- *More maintenance will be required for existing infrastructure.* Pipes, sewers, and treatment facilities must be overhauled to accommodate burgeoning usage.
- *Agricultural uses can contribute to harmful environmental phenomena.* Some examples are **erosion**, increased **desertification**, and **salinity**.
- *Water bodies such as rivers, wetlands, and bays can be lost.* High levels of water extracted from, and the polluted runoff that feeds into, such bodies of water can result in rapid degradation.

Doing Your Part: Tips for Water Conservation

1. *Check indoor appliances and devices that use water for leaks.* Silent and slow leaks around the house can add up. Studies show that homes can waste up to 10% of the water they use to leaks, which cost both families and the environment. Another large water-waster can be leaks in an irrigation system. Older sprinkler systems can lose between 50 and 75% of water used to leaks.
2. *Replace old Toilets, the largest single user of water in the home.* Efficient toilets, built after 1992, expend 1.6 gallons of drinking water per flush. Those built in the last ten years average 1.1 gallons. Before 1992, toilets used between 5 and 6 gallons per flush! You can check the date stamp inside the toilet by lifting the lid and looking underneath, at the back of the toilet, to find the manufacturer's imprint of the make, model and date of manufacture of the appliance.
3. *Replace your Clothes Washer, the second largest user of water in the home.* Energy Star™ rated washers use 35-50% less water and 50% less energy per load. This saves families money on both water and energy bills – and reduces the average family's environmental footprint.
4. *Landscape Wisely.* Select plants that are appropriate for your local climate conditions. Also consider trends towards more natural landscapes or 'wildscapes'. Remember also that most water is wasted in yards by watering when plants and grass do not need water -- or by insufficient maintenance to irrigation systems.

Water conservation practices such as these can save thousands of gallons of water per person -- per year!

Virtual Team Challenge: Spill!
Supplemental Curriculum

Environmental Awareness Handout #3

Business and Earth's Water Systems

Business and Water

Individual households only make up about 15% of the water consumption world-wide. The remainder is apportioned among other users – including businesses of all kinds. As current and future effects of climate change are coming to light, we are learning that all segments of society – government, consumers, and business alike – are responsible for contributing to – and helping us recover from – the global environmental crises that we face today.

Users of Water

Agriculture. An estimated that 69% of world-wide water use is for irrigation. It is estimated that between 15-35% of irrigation water is lost to runoff and evaporation. Traditional, wasteful irrigation methods such as furrow and overhead sprinkler irrigation are usually less efficient, and thought to be responsible for much of this waste. More efficient irrigation methods such as drip or trickle irrigation, surge irrigation, and others - while more expensive - can minimize runoff and evaporation.

As earth's human populations soars, the demand for food will skyrocket – but the world still has a fixed water supply. Although efforts are underway to learn how to produce more food with less water, these improvements require significant initial investments into water saving irrigation technology. The challenge is to get agriculture – mostly in the developing world –to take on these investments even though they entail large initial costs – and limited immediate economic benefits.

Industrial. It is estimated that 15% of world-wide water use is industrial. Major industrial users include power plants, which use water for cooling (coal plants) or as a power source (hydroelectric plants). Also, mining, oil refineries and manufacturing plants all use water in their chemical processes.

While the portion of industrial water usage varies widely, and it is much lower than agricultural usage levels, we should nonetheless be concerned about business' water use. As commerce grows, so do the types of businesses that produce power, mine ores, or otherwise use large amounts of water. Industry must also play a role in conservation efforts in order to avoid the kinds of catastrophes foretold by organizations such as the United Nations, or the United States Department of the Interior.

Reducing our Dependence on the Water Cycle: Sustainable Development

One theory that businesses are turning to in addressing global environmental issues is *sustainable development*. Sustainable development focuses on 'development' rather than 'growth'. While economic 'growth' entails that economy becomes *bigger*, constantly needing ever more nonrenewable resources such as water, 'sustainability' means that the economy becomes *better*, using finite resources to enhance human quality of life. In the words of the United Nations Commission on Sustainability, it entails that we "meet the needs of the present without jeopardizing the ability of future generations to meet their own."

Although there is no single model for sustainable development that can be applied across all resource users, all efforts towards sustainability have the following in common:

- 1) *Product, design, and process changes inspired by biological processes.* Emphasis is placed on mimicking the processes of our bodies and our planet, which among other things, converts most types of waste from certain processes into input for others.
- 2) *Shift from production of goods to providing services.* What if someone made a car that lasted forever? Chances are, after everyone purchased one, sales would sharply fall off. Moving from product delivery to product-and-service delivery means that companies will have incentive to make products with longer lives – and then provide profitable service activities to support customers throughout the lives of their product purchases.
- 3) *Investment in 'Natural Capital'.* Sustainable development theories look at our finite natural resources as a 'pool' of capital which is capable of 'paying regenerative 'interest' as it is 'reinvested.' In fact, sustainable development is sometimes known as 'natural capitalism' because of its emphasis of employing 'prudent financial thinking' to our uses of environmental resources. We should try to 'live off the interest' portion of our resources as they grow, rather than exhaust our resources unsustainably.

Representing what some call a "second industrial revolution", the 'sustainability' model has the promise of rethinking the way humans look at the environment, at economics – and also at the way they live.