LONGWOOD GARDENS

H2O Program

Pre- and Post-Activities

BACKGROUND FOR TEACHER

The H2O Program encourages students to learn about water and the water cycle by discovering how plants and people use water. Students will be inspired to conserve this natural resource at home and at school.

Water is essential to life on Earth. Water sources include groundwater, creeks and streams, rivers, estuaries, bays, and oceans. A watershed includes the network of flowing water, as well as the land surrounding it. Water covers about 71% of the Earth's surface.

On the grounds of Longwood, water runs clean, clear, and cold from springs and lakes before winding its way through tributaries of the Red Clay, White Clay, and Brandywine Creeks. Wide riparian buffers—streamside plantings of native trees and shrubs—work to filter storm runoff to keep the water free of pollutants and excess nutrients. Research by the Stroud Water Research Center recommends buffers of nearly one hundred feet for adequate stream protection.

In the 86 acre Meadow Garden located on Longwood's property, is the Hourglass Lake. Hourglass Lake was originally called Wild Pond, and was created as a water supply and for fire protection in 1959. Its placement coincided with a wet, marshy area and stream course, creating a naturalistic water feature. Wetlands are established around the periphery of the lake today and are a thriving habitat within the Meadow Garden. Though originally created through human intervention, the lakes are gradually being reclaimed by nature but are still guided by the human hand.

Longwood uses proven techniques to reduce the overall water usage while conserving available resources. Among the technologies used to reduce water consumption in the Gardens are timer and drip irrigation systems and UgMO—a novel technology that measures water content in the ground. Longwood has an on-site waste water management system, and is able to treat 100 percent of the water from restrooms, restaurants, showers, and tenant homes for irrigation of non-edible crop fields. What isn't used for irrigation is distributed over a spray field on the property, thereby returning it to the aquifer. The use of native plant communities protects the watersheds by absorbing nutrients and slowing storm water run-off.

LONGWOOD GARDENS

VOCABULARY

Accumulation	Evaporation	Point Source Pollution
Aquifer	Ground Water	Precipitation
Collection	Lentic System	Runoff
Condensation	Lotic System	Transpiration
Conservation	Non-Point Source Pollution	Watershed

NEXT GENERATION SCIENCE STANDARDS

Standard: K-8-ESS2. Earth's Systems
Performance Expectations

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

5-ESS2-2 Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

PRE- AND POST-ACTIVITIES

Water Cycle in a Bag (K-8)
Curriculum Connections: Science, language arts
Materials: Printed illustrations of hydrologic cycle (see web resource: nasa.gov/education/water-cycle), colored markers, black permanent marker, handful of soil, scissors, spray bottle, water, plastic quart-size sealable bag, handful of small pebbles and gravel, plants 4" or smaller (optional)

1. Cut out the illustration of the hydrologic cycle and place it inside the quart-size bag.
2. Using a black permanent marker, trace the outline of the illustration onto the bag. Use colored markers to color in the design as desired. Select a dark color marker and label the different parts of the water cycle. When you have finished, remove the picture from the bag.
3. Place a handful of small pebbles and gravel in the bottom of the bag to represent the aquifer.
4. Place a handful of soil on top of the pebbles and gravel.
5. If desired, place a tiny plant in the soil.
6. Gently spray water over the soil and rock mixture until it is moist.
7. Seal the bag and place it upright in an area that receives indirect sunlight.
8. After a few days, make observations. Use the illustration on the outside of the quart-sized bag to identify the stages of the water cycle observed.

9. Discuss the differences in bags. Do all the bags look the same? What other factors play a role in the visible signs of the water cycle?

Extension/Modification Activity: Have half of the students place bags in a shady spot, and half of the students place bags in a sunny spot. Observe differences and similarities. What role did the sun play in the water cycle?

Make it Rain (K-2)
Curriculum Connections: Language arts
Materials: none

1. Tell the students they are going to create a group rainstorm with hand and body motions.
2. Instruct students to begin by snapping fingers to create raindrops.
3. Next, by rubbing palms together the rain starts falling harder.
4. Students will stomp their feet to create thunder.
5. Slowly introduce and eliminate each sound. Be the class conductor.
6. Have students take turns being the conductor and create different storm scenarios.
7. Option to add new sound effects for: hail, lightning, or snow.

Extension/Modification Activity: Students may act out the various forms of water (liquid, solid, vapor) using body motions. Introduce the water cycle and discuss where rain comes from during a storm and where it goes.

Measuring Lost Water (3-8)
Curriculum Connections: Mathematics, language arts, science
Materials: Sink with faucet, large container, measuring cup, graph paper, pencils, ruler

1. Give each student a piece of graph paper and a pencil.
2. Have students create a simple graph using a ruler.
3. Along the left axis students should mark units of liquid measurement in cups.
4. Along the bottom axis students should mark units of time by hour.
5. Place a bucket under the faucet being used in this experiment. Be sure the bucket is empty.
6. Turn the handle on the faucet until it has a very slow drip.
7. After one hour, use the measuring cup to determine the amount of water collected.
8. Record your data on the graph.
9. Discuss the results of the experiment.

   Discussion Questions

   - How much water dripped after 1 hour? 4 hours? 24 hours?
   - What would be the estimated amount of water wasted after 1 week?
   - How much water do you use when water runs while brushing your teeth?
   - What other daily routines waste water?

10. Continue collecting water for the remainder of the day, recording the collection each hour.
11. At the end of the experiment, reuse the water by giving a drink to a plant or tree.

Extension/Modification Activity: Further calculations can be done depending on the ability of the students. Calculate the amount of water wasted for months or a year. Think about what would happen if the water leaked at a faster rate?

My Rain Gauge (K-5)
Curriculum Connections: Mathematics, science
Materials: Empty two liter plastic bottles (1 per student), scissors or box cutter, clear packing tape, black permanent markers, rulers, student handout (My Rain Gauge), pencils, additional colored permanent markers (optional)

1. Cut the plastic bottle in half using scissors or box cutter. (This should be done in advance by an adult.)
2. Flip the neck half of the bottle into the bottom half of the bottle. Secure with clear packing tape. This will serve as a funnel and a container that will collect rain water. This can be called a rain gauge.
3. Using the ruler and black permanent marker, measure and mark inches on the side of the plastic container.
4. Allow students to decorate the rain gauge with colored permanent markers.
5. Place the newly created rain gauge outdoors where it will collect rain.
6. Each week, record the amount of rain collected in the rain gauge. Be sure to empty the water collected into a plant each week.
7. Record measurements over several weeks.
8. At the end of the month, add up measurements recorded to see total rainfall for the month.

Extension/Modification Activity: Students can keep a log of total rainfall each month during the school year. Compare monthly rainfall. Which months had the most rainfall? Compare rainfall to other geographic locations.

WEB RESOURCES FOR TEACHERS AND STUDENTS

NASA Precipitation Education
http://www.nasa.gov/audience/forstudents/5-8/features/Observatorium_Feat_5-8.html

USGS: Science for a Changing World
http://water.usgs.gov/edu/watercycle.html

The Water Page
http://www.thewaterpage.com/waterbasics.htm

Environmental Protection Agency Water Sense Kids
https://www3.epa.gov/watersense/kids/index.html

SUGGESTED PRINT RESOURCES FOR STUDENTS

Bailey, Jacqui, and Matthew Lilly. *A Drop in the Ocean: The Story of Water*. Minneapolis, MN: Picture Window, 2004. Print.

Barss, Karen. *Clean Water*. New York: Chelsea House, 1992. Print.

Bullard, Lisa, and Xiao Xin. *Watch over Our Water*. Minneapolis: Millbrook, 2012. Print.

Hooper, Meredith, and Chris Coady. *The Drop in My Drink: The Story of Water on Our Planet*. London: Frances Lincoln, 1998. Print.