March 2005

The Classroom Naturalist

Milton Outdoor Classrooms

The Water Cycle: What Goes Up Must Come Down

Did you know that this winter is the 3rd snowiest winter on record for Massachusetts with a total of 118.2 inches as of March 17th?

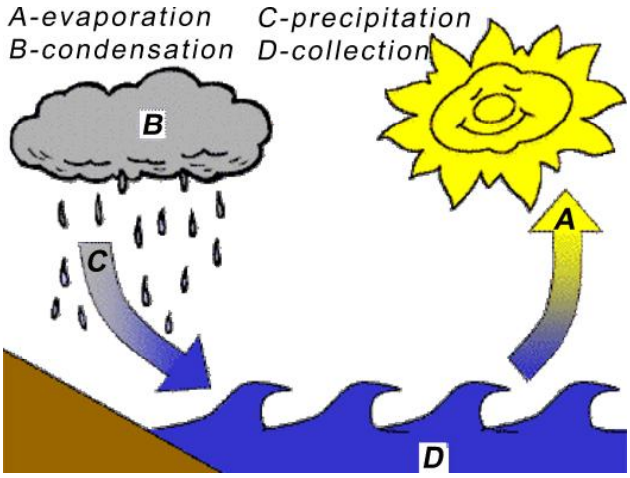
Why is snow so important? Where does all the snow go when it melts? Snow and rain and all the seasonal changes are important parts of the Water Cycle!

Everything Starts with the Sun!

The water cycle (shown in the illustration to the right) has four main parts: **evaporation, condensation, precipitation and collection.** Since the earth has a limited amount of water, the water cycle plays an important role in maintaining our habitats on earth:

1. **Evaporation:** The sun melts snow and warms the water in streams, lakes, rivers, and wetlands. As the sun warms the water, the water evaporates and becomes *water vapor*, which goes into the air.

2. **Condensation:** Water vapor is carried by the air moving over the earth. When the air is cooled (such as when it is forced up by colder air or by mountains and hills), the vapor condenses into droplets of liquid water, forming clouds.



3. **Precipitation:** When the air is saturated with water (it can no longer hold any more water), the water falls to the earth in the form of rain, snow, sleet or hail (depending on the temperature at the time).

4. **Collection:** About 75% of precipitation falls directly on the oceans. Some of the rest runs off the land into streams, rivers, and lakes. From the rivers, it flows back to the ocean. For instance, the Mississippi River carries rain and melted snow from Minnesota and Canada all the way to the Gulf of Mexico!!! The rest of the precipitation evaporates immediately or soaks into the soil to be used by plants and animals. If it goes deep enough into the ground, it becomes part of the *ground water* supply (water that is tapped by wells in some areas). Ground water moves slowly through the ground to the rivers and returns to the ocean. This movement of ground water keeps the rivers flowing during period when there is no precipitation.

The Oceans Contain Most of Our Water

Oceans, which cover about 70% of the earth's surface, contain about 97% of all water on earth and are the source of most of our precipitation. When ocean water evaporates, the salt is left behind, so that the precipitation that falls to earth is fresh water.

Only about 3% of the water on earth is fresh water—most of that (about 2%) is not easily accessible to people because it is locked in icecaps and other glaciers. Rivers and lakes contain only about one-fiftieth of 1% of the earth's water!

Why is Precipitation Important?

Precipitation plays an important role in the water cycle. It is the main way that water is recycled. A drought occurs when there is not enough precipitation to replenish the water that is evaporated daily by the sun. When we get sufficient amounts of rain and snow, we are able to keep a good balance. There are places around the world and in the United States that experience long periods of drought. In these areas, rivers, streams and lakes may diminish or completely dry up.

Of course the opposite of drought is flooding. When areas become very saturated with precipitation, rivers, streams and ponds can overflow their boundaries and cause flooding. You can see this happen sometimes at Turner's Pond. During spring and fall, the pond water level rises and floods the path around the pond in some places.

The Water Cycle and Habitats

Water is one of the four main components of an animal's habitat. When the water cycle is out of balance, it affects habitat, and therefore the animals and plants that live there. When rivers or streams dry up or become polluted, animals and plants will not be able to thrive in that area. Animals and plants that cannot adapt to changes in habitats or that cannot move will eventually become endangered and later, extinct. The small whorled pogonia, the dwarf wedge mussel and the Plymouth red belly turtle are examples of plants and animals in Massachusetts that are endangered due to changes in their water sources.

What Can We Do ?

What are some things we can do to help?

- **Plant trees and other plants.** After plants have drawn water from the ground through their roots, they **transpire** or lose excess water out of their leaves. Transpiration gives evaporation a hand in getting water vapor into the air. For example, a birch tree gives off about 70 gallons (260 liters) of water a day! Plants also are a source of food and water for animals.
- **Conserve water**. Be aware of how much water you are using. Keep a record at home of how and why you are using water. Then come up with a family plan to conserve.
- **Protect rivers and streams.** Protect natural water sources by not polluting and picking up trash when you see it. Stay on the trails surrounding ponds, lakes, stream, etc. so you do not contribute to erosion. Do not use salt and other chemicals near natural water sources.

What other ideas can you come up with?

Projects to Do with Your Students

Science Observations

1. **Make a rain gauge**. Your students can make a rain gauge and measure the amount of precipitation over a period of time. They can compare the rainfall to average amounts and make predictions based on their observations. http://www.k12science.org/curriculum/weatherproj2/en/docs/raingauge.shtml describes how to make an easy rain gauge.

2. **How much water does snow make?** Collect two cups of snow and place them in an aluminum pan. When the snow melts, measure the amount of water. How much water did you get from the snow? Discuss with the students their findings and research snow and rain. For every inch of rain, how much snow would you get?

3. **Evaporation:** Place pans of water in different spots in the classroom and outside. Compare the rates of evaporation.

4. **Build your own water cycle:** There is a great experiment on building a water cycle found at http://www.epa.gov/safewater/kids/grades_k-3_watercycle_activity.html.

5. **Watch the changes in Pine Tree Brook.** Observe Pine Tree Brook right from the Glover Bridge. Observe the brook daily for a month. Using visual clues (rocks in the river, plants on the side, etc.), how can you gauge the changes in water levels? During the same time frame, keep track of precipitation. How do your observations correlate to the precipitation amounts?

6. **Follow Pine Tree Brook and the Neponset River.** Using maps and other sources, follow the brook and the Neponset River from where they begin and where they end. What towns does the Neponset River run through? (Pine Tree Brook drains into the Neponset River, which then goes into Boston Harbor and the Atlantic Ocean.)

Resources: www.epa.gov, www.kidzone.com, www.k12science.org, and *World Book.* Also, *Endangered: Some Massachusetts Animals and Plants at the Crossroads*, pamphlet published by Massachusetts Department of Food and Agriculture and the Massachusetts Division of Fisheries and Wildlife.

MA Curriculum Framework Learning Standards Covered:

Science and Technology:
- Strand One: Earth and Space Science, PreK-2--Learning Standards 1, 4, 5,
  Grades 3-5—Learning Standards 6, 7 and 10
- Strand Three: Physical Sciences, Pre-K-2--Learning Standard 2,
  Grades 3-5--Learning Standards 2 and 3

English Language Arts:
- General Standard 18 (Dramatic Reading and Performance)
- General Standard 19 (Writing)

Writing Connections

1. Make up a story about Pine Tree Brook and/or the Neponset River. It may include details of the water cycle.

2. Write a song or small play about the water cycle. Act out your play.

3. Make up rhyming words for the water cycle words (precipitation, condensation, etc).

4. Write poetry about water or weather. There are some great poems about weather in the book Sing a Song of Popcorn by M. White, et al.

Clouds
By Christina G. Rossetti

White Sheep, white sheep
On a blue hill.
When the wind stops,
You all stand still.
When the wind blows
You walk away slow.
White sheep, white sheep
Where did you go?

Great Blue Hill Observatory Web Site Offers Treasure-Trove of Weather Information

Milton is the home of the Blue Hill Meteorological Observatory, which is the oldest continuous weather recording station in North America. The observatory, located at the top of the Great Blue Hill, has a terrific web site that includes:

- A web cam at the summit of the Great Blue Hill
- Weather archives that include data on temperature, precipitation, snowfall, and means and extremes
- Many great weather/science links

Check it out with your students at www.bluehill.org!

Plant of the Month: Pussy Willow (*Salix discolor*)

The pussy willow tree is a true sign of spring and is a favorite because of its cute, fuzzy buds on long twigs. The buds typically come out in late March or early April.

Just like bayberries, pussy willows are dioecious. This means that there are male and female pussy willow trees. The buds, or catkins, on the male pussy willow trees look different from those on the females. The male catkins are showier and these are the ones that we usually see sold in the stores. Both types of catkins turn into numerous tiny flowers later in the spring (late April). Wind, bees, and other insects pollinate the flowers and, in June, the female shrubs release feathery seeds.

Pussy willows grow in wetlands and near streams and rivers in the eastern United States and Canada. They are deciduous shrubs, meaning that they drop their leaves in the fall and grow new leaves from buds in the spring. The leaves of pussy willows are long, fine-toothed ovals that appear in early May. Pussy willows can grow up to 20 feet high.

Like all willows, the pussy willow contains a compound called “salicin,” the active ingredient in aspirin. Native Americans used to drink a tea made from willow bark and roots as a painkiller and anti-fever medicine.

Pussy willows are important for wildlife. The buds are food for many animals like ruffled grouse, beaver, and squirrels. The leaves are rich in Vitamin C and zinc, and are eaten by many moth and butterfly larvae. The bushes are also a popular nesting site for the American goldfinch and provide good cover and protection for many types of birds and animals.

In addition to spreading by seeds, pussy willow twigs that break off the tree and fall to the

ground root to form exact copies of the parent. Pussy willows produce a universal rooting hormone, which makes them root quickly. For this reason, it is very easy to propagate (multiply or spread) pussy willows. You can simply stick cut branches that are at least a foot long into the soil when the weather gets warm (cut edge down), and the pussy willows will grow. The branches can also be put into water inside to root them, and then transplanted outside when danger of frost is past. If you put branches of other plants in with the pussy willows that are rooting in water, the other plants usually root too (due to the presence of the rooting hormone).

Right now we are rooting pussy willows so that we can plant them in the Glover Outdoor Classroom in a month or so. They will be on display in the Glover Library. Take a peek and watch them putting down roots in the water! The pussy willows will be planted in the Marsh area of the courtyard where the soil is moist and there is full sun. They grow very rapidly—sometimes more than a foot (30 cm) a year, so they would be great plants to graph the height of over time.

Sources: landscaping.about.com, borealforest.org, www.macphailwoods.org, bobvila.com., and *Native Trees, Shrubs & Vines* by William Cullina.

Visit us on the web at
http://www.miltonoutdoorclassrooms.com