Sweet Sugaring

Enduring Understandings
- We can impact cycles: Humans can use the water cycle to their benefit.
- Sap, consisting mainly of water, can be changed into sweet syrup by heating the sap to evaporate most of the water.

Objectives
- Children demonstrate an understanding of the sugaring process.
- Children show interest and curiosity about the water cycle.
- Children discover what happens to sap when it is boiled.

Directions
1. Ask the children, Have you ever tasted maple syrup? Do you know where we get maple syrup? Discuss the changes in the weather that signal its sugaring time, as winter turns into spring. Cold nights and warm days are a signal for the sap in trees to start moving.
2. Read Sugarbush Spring by Marsha Wilson Chall and talk about what had to happen to make maple syrup.
3. If possible, tap a sugar maple tree in your school-yard. Trees that are 31–53 inches in circumference can safely take one tap, 54–75 inches 2 taps, and over...
Sap Facts

- All trees have sap but the sugar maple has a higher sugar content than other trees. Red maple and birch trees are also tapped by some sugarmakers.

- How can you tell if a tree is a sugar maple? Sugar maples have opposite branching. This means they have branches and buds directly opposite each other on a limb (unless a branch has broken off). There are four tree species that share this characteristic of opposite branching: maple, ash, dogwood and horse chestnut. Together, foresters call them the “MAD HORSE” trees. (“MAD” contains the first letters of the names of maple, ash and dogwood.) Once you have identified a tree as MAD, look at the bark to determine if it is a maple. Maple trees have long, irregular plates of grey-to-brown bark that lift along one edge. Also, the sugar maple’s winter buds are sharply pointed, conical and brown in color.

- Sap is 98% water and 2% sugar and minerals and nutrients. It takes an average of 40 gallons of sap to make 1 gallon of maple syrup!

- Once leaves start to bud, sugaring is over as the taste of syrup is “off”.

75 inches, 3 taps. An electric drill with a 7/16 or 5/16 drill bit can be used to drill a hole 2–2 ½ inches deep into the tree. Have the children gently tap the spiles with a hammer into the tap holes. Secure a bucket or plastic container to the tap to collect the sap. Lids are helpful to keep out the snow and rain. (You don’t need more water!)

4. Collect sap. You are at the mercy of nature so you need to be flexible. If the sap is really flowing, try to collect at least several gallons and start sugaring with your class. Children can collect the sap. Remember it takes around 40 gallons of sap to make one gallon of syrup!

5. Boil the sap in your soup pot at 219°F, testing with a candy thermometer. Once enough water has evaporated off, you’ll know it’s syrup because it will come off a ladle in a sheet (see photo, p.____). Pour the hot syrup through a wool or cotton filter to remove the niter, or sugar sand, that naturally occurs when boiling sap. Store your syrup in the refrigerator until using.

6. Process and reflect on the experience with the children by engaging in a conversation guided by the discussion questions.
Discussion Questions

- Where does maple syrup come from?
- How do we get the sap out of the trees?
- How does the syrup turn into sap?
- Why do we only make maple syrup in the late winter?

Maple Math

The number of gallons of sap needed to make a gallon of syrup varies with the sugar content of the sap. Using a special instrument called a refractometer, a sugar maker can determine the percent of sugar in a maple tree’s sap. (The average for maple trees is 2%.) Then, using the Jones Rule of 86, the sugar maker simply divides 86 by the % sugar to calculate the amount of sap needed to produce a gallon of syrup.

What makes sap run?

Sap flows through a portion of the outer tree trunk called sapwood. Sapwood consists of actively growing cells that conduct water and nutrients (ie. sap) from the roots to the branches of the tree. During the day, activity in the sapwood cells produces carbon dioxide (CO₂) gas, which is released into the spaces between the cells. Additional CO₂ dissolved in the cool sap is also released into the intra-cell spaces as the day warms up. This release of CO₂ causes pressure to build up in the cells. A third source of pressure is called osmotic pressure, which is caused by the presence of sugar and other substances dissolved in the sap. When the tree is wounded, like when a tap is hammered into it, the pressure pushes sap out of the tree.

At night or when temperatures go below freezing, the CO₂ cools and contracts, and some becomes dissolved in the cooled sap again. Also, some of the sap freezes. All three of these factors create suction in the tree, which causes water from the soil to be drawn up into the roots and travel up through the sapwood. When temperatures rise above freezing the next day, sap flow begins again.