



## Tapping Into Maple Tradition

**Lesson Title:** Sweet Sugaring

**Submitted By:** New Hampshire Agriculture in the Classroom

**School or Affiliation:** with permission of Shelburne Farms

**Email:** nhaitc@nhfarmbureau.org

**Grade Level:** (check all that apply)

- ☒ Early Elementary (K – 2<sup>nd</sup>)
- ☒ Upper Elementary (3<sup>rd</sup> – 5<sup>th</sup>)
- ☒ Middle School (6<sup>th</sup> – 8<sup>th</sup>)
- ☐ High School (9<sup>th</sup> – 12<sup>th</sup>)

**What National Agriculture Literacy Outcomes does your lesson address?**

<http://www.agclassroom.org/get/doc/NALObooklet.pdf>

T1.K-2b  
T1.3-5b  
T4.6-8bi

**What Common Core Standards does your lesson address?**

K-LS1-1  
1-LS1-1  
2-LS2-1  
3-LS3-2  
4-ESS3-1  
5-ESS2-2  
MS-LS2-3  
CCSS.ELA-LITERACY.RL.K.7  
CCSS.ELA-LITERACY.RL.1.7  
CCSS.ELA-LITERACY.RL.2.7  
CCSS.ELA-LITERACY.RL.6.1  
CCSS.ELA-LITERACY.RL.7.1  
CCSS.ELA-LITERACY.RL.8.1  
CCSS.ELA-LITERACY.RL.3.1  
CCSS.ELA-LITERACY.RL.4.1  
CCSS.ELA-LITERACY.RL.5.1  
CCSS.ELA-LITERACY.SL.K.1  
CCSS.ELA-LITERACY.SL.1.1  
CCSS.ELA-LITERACY.SL.2.1  
CCSS.ELA-LITERACY.SL.3.1  
CCSS.ELA-LITERACY.SL.4.1  
CCSS.ELA-LITERACY.SL.5.1  
CCSS.ELA-LITERACY.SL.6.1  
CCSS.ELA-LITERACY.SL.7.1  
CCSS.ELA-LITERACY.SL.8.1

**Brief description of your lesson plan:**

Sap, consisting mainly of water can be changed into sweet syrup by heating the sap to evaporate most of the water. Humans can use the water cycle to their benefit.

**Time:**

2 hours to read and discuss book, then collect sap. Boiling the sap depends on quantity and method. Allow a full day for this part.

**Materials**

- The book *Sugarbush Spring* by Marsha Wilson Chall
- Access to sugar maple tree(s)
- Early spring weather, when days are above freezing temperatures, but nights dip below freezing
- Electric drill with 5/8" bit
- Taps (also called spouts or spiles)
- Bucket or plastic container
- Soup pot
- Candy thermometer
- Wool or cotton filter (can use a coffee filter)

**Vocabulary:**

Sap - The watery fluid in a plant that carries food and other substances, and can get sticky as it dries.

Sugarbush - A forest where Sugar Maple trees are used to make maple syrup

Syrup - A sweet, thick sticky liquid made by boiling down sap

Tapping - The process of drilling into the trunk of a maple tree and placing a spout (tap) where the sap will run out into a bucket

**Background:**

See *Maple Teacher Background* document <sup>2</sup>

What makes the 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 (CO<sub>2</sub>) gas, which is released into the spaces between the cells. Additional CO<sub>2</sub> dissolved in the cool sap is also released into the intra-cell spaces as the day warms up. This release of CO<sub>2</sub> 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 a tap is hammered into the tree, the pressure pushes sap out of the tree through the hole. At night or when temperatures go below freezing, the CO<sub>2</sub> 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. <sup>1</sup>

**Interest Approach – Engagement:**

1. Ask the students if they have ever tasted maple syrup.
2. Do they know where maple syrup comes from?
3. Discuss the weather changes that signal that its sugaring time, as winter turns into spring. Cold nights and warm days are a signal for the sap in trees to start moving.

**Procedures:**

1. Read *Sugarbush Spring* by Marsha Wilson Chall and talk about what had to happen to make maple syrup. (more appropriate for younger students)
2. If possible, tap a sugar maple tree in your school yard. Trees that are 31-532 inches in circumference can safely take one tap, 54-75 inches 2 taps and over 75 inches, 3 taps. Use an electric drill with a 5/16" bit to drill a hole 2 to 2.5" 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 snow, rain and bugs.
3. 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! Of course, you can make a smaller amount.
4. 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. The teacher can pour the hot syrup through a wool or cotton filter to remove the niter, or sugar sand. Store your syrup in the refrigerator until using.
5. 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?

**Did you know? (Ag 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. Once you have identified them as opposite branching, look at the bark. 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, minerals and nutrients. It takes an average of 40 gallons of sap to make 1 gallon of syrup!
- Once the buds on a tree start to grow, the sugaring season is over as the taste of the syrup is "off".

**Enriching Activities:**

- Use the Sugaring Tools Cards as sequence cards or to match actual tools, or as prompts for writing stories
- Maple syrup taste testing: have samples of real maple syrup and several samples of commercial pancake syrups. If you check the labels, most of the commercial syrups have no maple syrup in them, but rather corn syrup and high fructose corn syrup, caramel coloring and "natural flavors". Using coffee stirrer sticks, small spoons or small paper cups, have each student sample a small taste of each. Graph the results for favorite and/or which is "real" maple syrup.
- 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 % of sugar to calculate the amount of sap needed to produce a gallon of syrup.

- Visit a real sugar house to see the process in action or invite a local sugar maker into your classroom.

**Please list any website URLs referenced in your lesson:**

<sup>1</sup> Cornell University Extension: <http://maple.dnr.cornell.edu/FAQ.htm>

<sup>2</sup> WestView Learning -

<https://www.teacherspayteachers.com/Product/Maple-Sap-to-Maple-Syrup-An-Integrated-Unit-for-Grades-4-1726937>

**Sources/Credits:**

Used with permission from Shelburne Farms

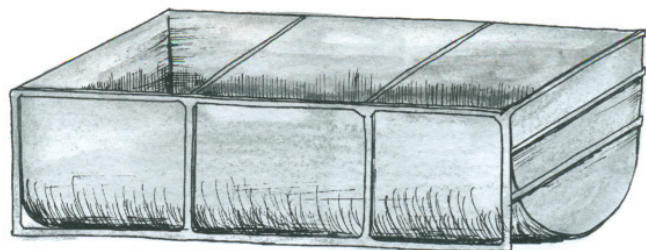
**Related Resources:**

Exploring Maple Syrup – companion resource to *Sugarbush Spring* from New York Agriculture in the Classroom [http://www.agclassroom.org/ny/programs/pdf/literacy/lesson08\\_exploring.pdf](http://www.agclassroom.org/ny/programs/pdf/literacy/lesson08_exploring.pdf)

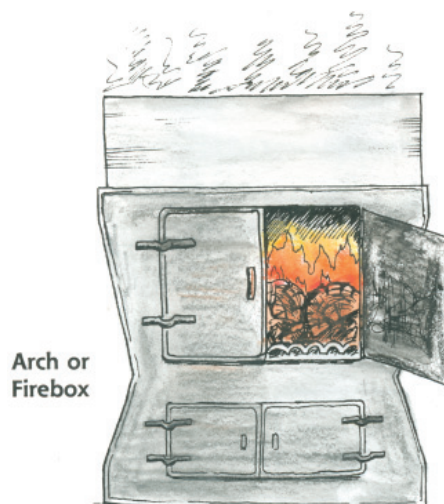
Sugaring Tool Cards from Shelburne Farms -

[https://drive.google.com/open?id=0B\\_m8Lfd\\_tvOLMm00a0sycEtSWDA](https://drive.google.com/open?id=0B_m8Lfd_tvOLMm00a0sycEtSWDA)

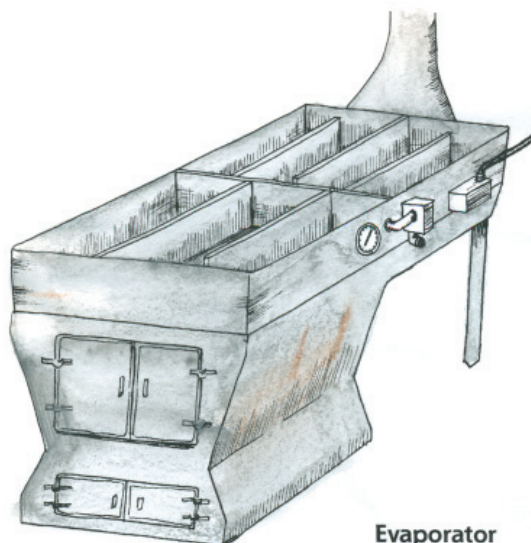
# Sugaring Tools



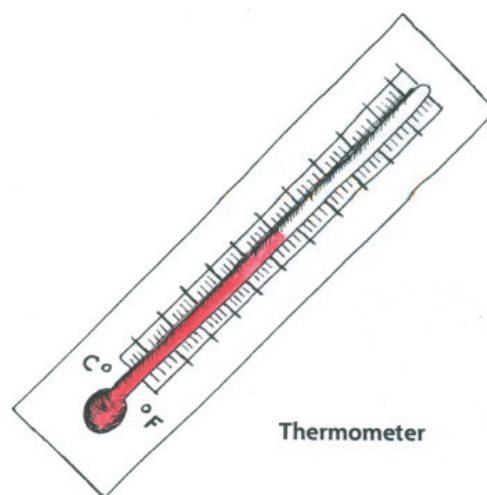
Holding Tank



Arch or  
Firebox



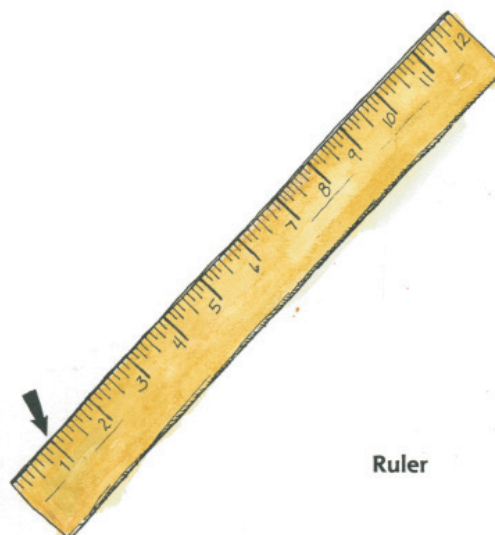
Evaporator



Thermometer



Wood

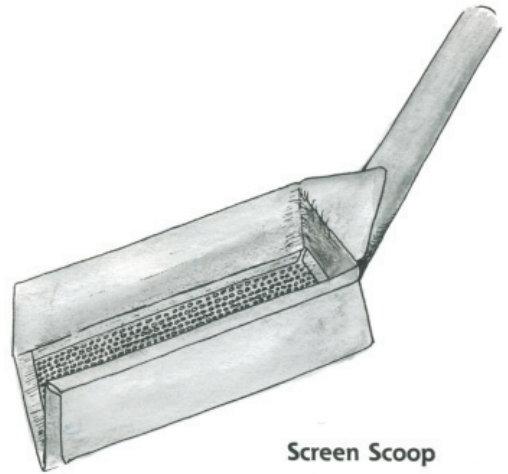


Ruler

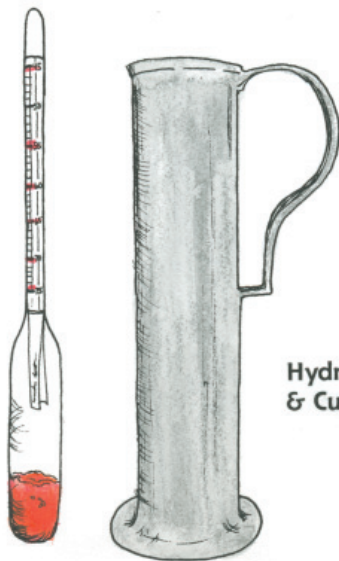




Scoop for Sheetting



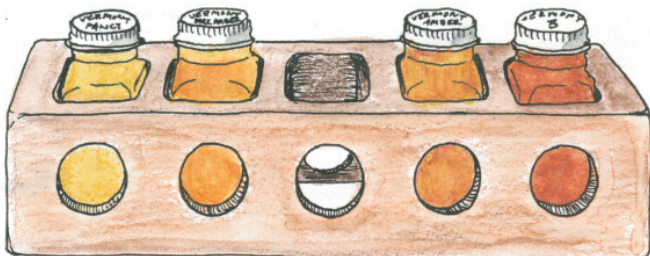
Screen Scoop



Hydrometer  
& Cup



Gloves



Grading Kit

