Maple Sugaring on Campus

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Maple syrup production is a multimillion dollar forest industry centered in the northeast United States. While the region of maple sugaring (the term used to describe the maple syrup industry) overlaps much of the Sugar Maple (*Acer saccharum*) range, other maple species produce sweet sap that can be used to produce maple syrup. In this lessons students should be able to produce maple syrup from maple trees in High Point, North Carolina. Students will learn and use maple sugaring terminology, equipment, and attribute both climate and tree characteristics to sap collection. Finally, students will produce syrup from the maple sap and enjoy a pancake luncheon with the syrup they produce.

Area of commercial maple syrup production in North America

Terminology

Producers of maple syrup use a unique vocabulary in their profession, and in this lesson students are required to use the following terminology:

Maple Sugaring – The industry/act of making maple syrup
Sap – The liquid exuded from a wound in a tree.
Tap – The hole/device put in a tree to extract sap
Run – When the sap is flowing.
Syrup – The boiled-down, concentrated sap that has taken on a sweet, dark, sticky appearance.

Supplies

Maple Trees (sugar, red, silver)
Drill with 7/16 drill bit
6 Buckets/lids
6 Stainless steel taps
Hammer
Cheesecloth, funnel, 2 5-gallon storage vessels
Hydrometer
10-gallon evaporator pan with full propane tank.

Procedure

Geographic range of red maple in North America

Geographic range of silver maple in North America

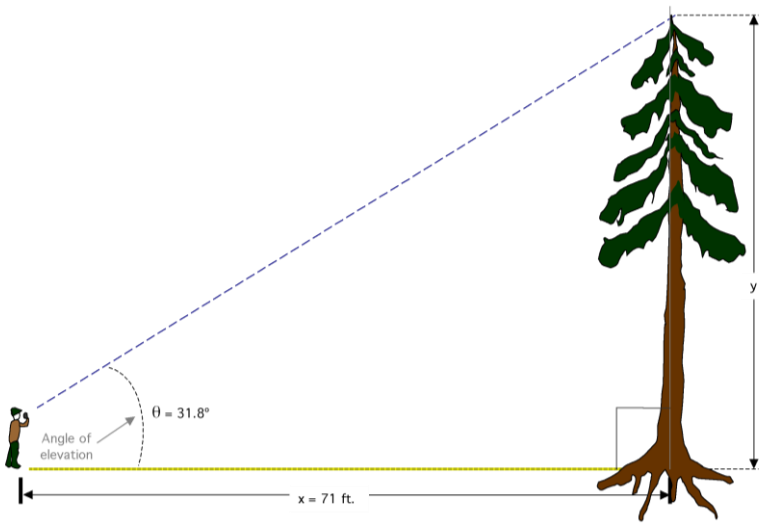
Students will identify maple trees on campus to be tapped for maple sap. Both Red and Silver maples can be found in High Point, however sugar maple are often planted out of their native range and can be used.

Begin the lesson with an introduction and overview of maple syrup production, highlighting the species used, climate/weather conditions needed, process from tapping to bottling syrup, the economic impact of this agroforestry industry in the Northeast, and how the same practice can be undertaken in High Point, North Carolina using similar species.

Students will select one tree per group and take the following measurements: height, trunk diameter, and any special features such as number of trunks, visual deformations, and anything other notable characteristics that may affect sap run. Have students record their features in the data sheet below.

Height is calculated using trigonometry where if students can measure the base length of a triangle and the angle to the top of a tree they can use the following formula to calculate height:

Height (y) = tan (angle) * base



Students gathering measurements to calculate tree height

Students can measure trunk diameter with diameter tape. Once tree measurements are made, the teacher can drill the tap hole into the sapwood of the tree (only 2 inches in) with a sharp drill bit and have students install the taps with a hammer. Once the tap is installed students can hang the metal pails from the taps. Make sure students cover the pails with roofs to keep debris out. Also create "experiment in progress" signs and post on all tapped trees.

Mr. Patterson tapping a maple tree

A tapped maple with bucket installed

Students recording data

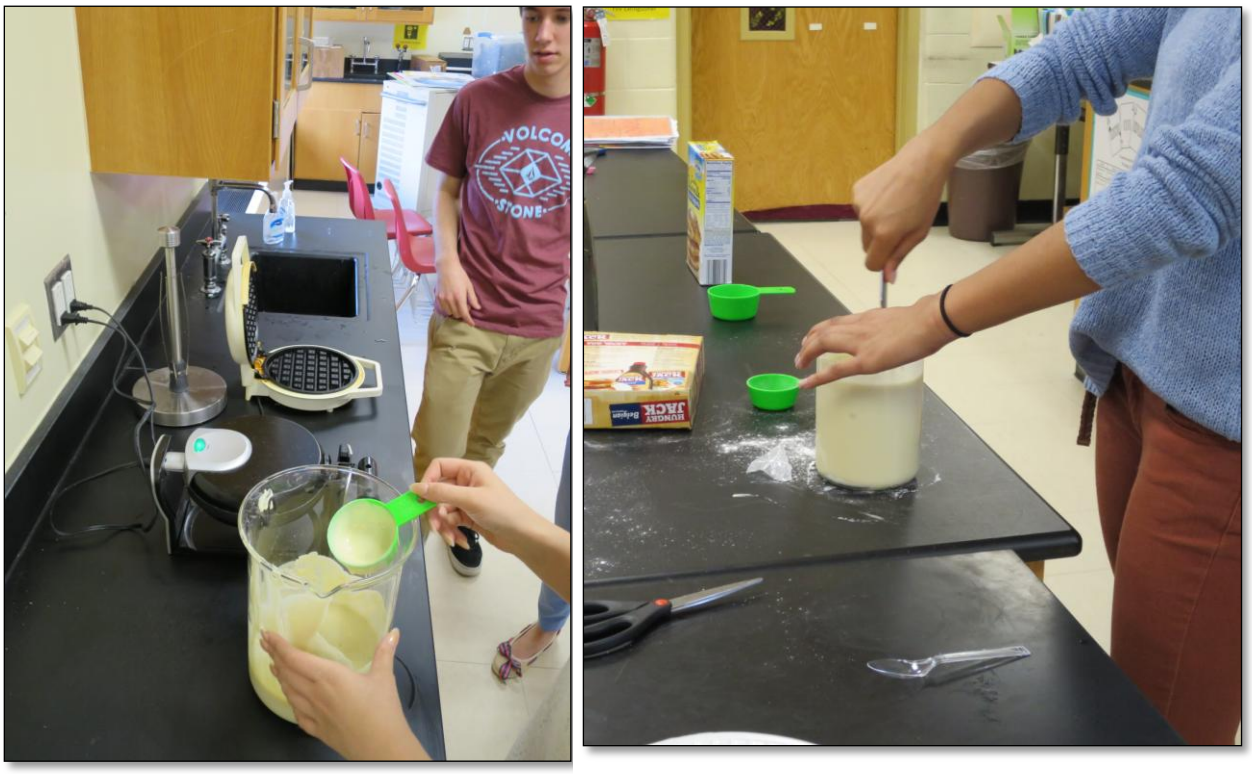
Have students return to their tree daily and record the volume of sap collected in their data table along with relevant daily weather data. Return all collected sap to the 5-gallon storage vessel with the funnel and filtering the sap through the cheesecloth.

After one week students will boil down 10-gallons of sap to produce maple syrup. Maple sap will have a sugar concentration of 1-6% and must be reduced to 66% to become maple syrup. Roughly 40 liters of sap are used in making 1 liter of syrup in commercial productions. Use the 10-gallon evaporator pan to continuously boil down the sap checking its sugar concentration with the hydrometer. Once the syrup concentration meets 60%, cool the syrup and bottle for preservation. 10 Gallons of sap should yield roughly 1 quart of syrup.

10-gallon evaporator pan

Analysis

Students are required to write a summary paper describing the process of maple sugaring in detail. Their paper should evaluate the influence of daily temperature on the amount of sap that ran, and how tree morphology influences sap production. The paper should include an original interpretation of their data using graphing software (excel). Students will present their findings to the class during the pancake luncheon.



Students making waffles to enjoy with their homemade maple syrup

Data Sheet for maple sugaring

Describe your tree

Location on Campus:

Height (m):

** ***remember the tangent formula tan (x^0) * distance from tree = height***

Trunk diameter (cm):

Special features (i.e. 2 trunks, broken limbs, etc.):

Data Table

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Low Temp							
High Temp							
Precipitation							
Vol. sap (ml)							
Other notes							