WOLF RIDGE℠
ENVIRONMENTAL LEARNING CENTER

MAPLE TREES & SYRUP
ADVENTURE IN LEARNING LESSON

Lesson Description
This lesson describes the process of making maple syrup as well as the tree physiology that makes maple tapping possible. After reading the story page or viewing the story video, students can complete a series of math problems based on making and selling maple syrup. Finally, a tree identification activity helps students identify maple trees near them.

Guiding Question
What is the science behind maple tress and syrup?

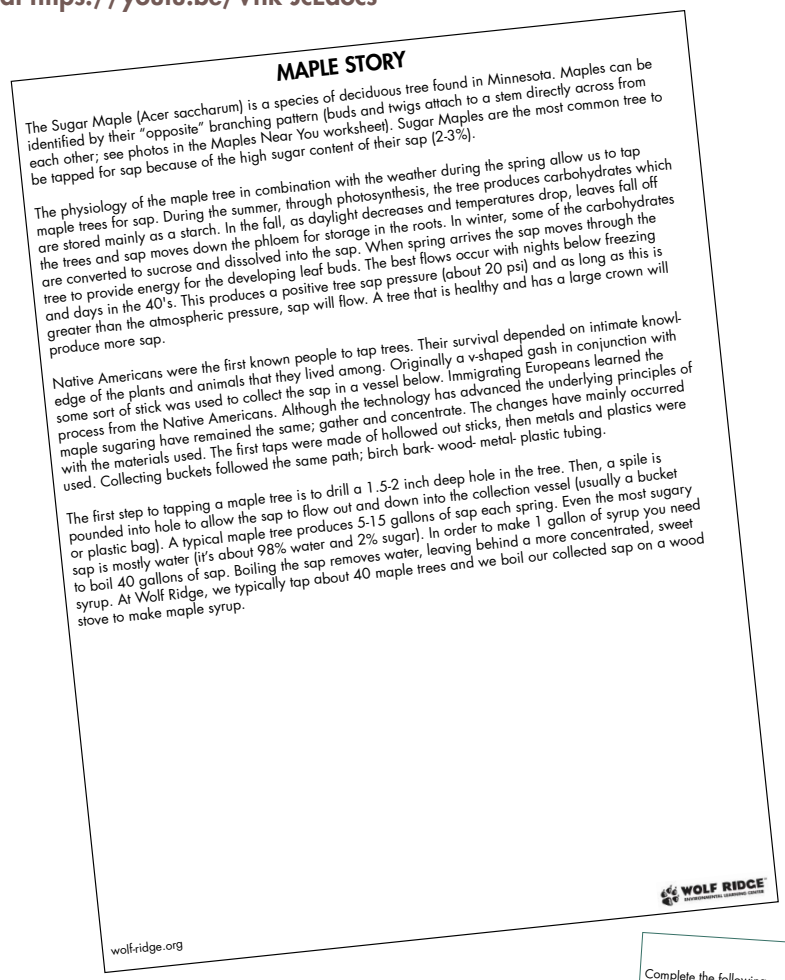
Concepts
1. Maple trees play an important role in several different ecosystems - food, forest, and economics.
2. The basic principles of maple syruping have remained the same since its discovery; gather and concentrate.
3. Math can be used to solve real-world problems.

Outcomes
Upon completion of Maple Syruping lesson students will be able to:
- Explain the syruping process from raw product of sap to the end product of maple syrup.
- Solve real-world math problems involving a maple syrup business.
- Identify Maple trees based on twig color, bud shape and leaf attachment pattern.

Minnesota Standards in Appendix

Watch this 5-minute video or read the story below:

Video also at https://youtu.be/Vhk-JcEaocs



MAPLE STORY

The Sugar Maple (Acer saccharum) is a species of deciduous tree found in Minnesota. Maples can be identified by their "opposite" branching pattern (buds and twigs attach to a stem directly across from each other; see photos in the Maples Near You worksheet). Sugar Maples are the most common tree to be tapped for sap because of the high sugar content of their sap (2-3%).

The physiology of the maple tree in combination with the weather during the spring allow us to tap maple trees for sap. During the summer, through photosynthesis, the tree produces carbohydrates which are stored mainly as a starch. In the fall, as daylight decreases and temperatures drop, leaves fall off the trees and sap moves down the phloem for storage in the roots. In winter, some of the carbohydrates are converted to sucrose and dissolved into the sap. When spring arrives the sap moves through the tree to provide energy for the developing leaf buds. The best flows occur with nights below freezing and days in the 40's. This produces a positive tree sap pressure (about 20 psi) and as long as this is greater than the atmospheric pressure, sap will flow. A tree that is healthy and has a large crown will produce more sap.

Native Americans were the first known people to tap trees. Their survival depended on intimate knowledge of the plants and animals that they lived among. Originally a v-shaped gash in conjunction with some sort of stick was used to collect the sap in a vessel below. Immigrating Europeans learned the process from the Native Americans. Although the technology has advanced the underlying principles of maple sugaring have remained the same; gather and concentrate. The changes have mainly occurred with the materials used. The first taps were made of hollowed out sticks, then metals and plastics were used. Collecting buckets followed the same path; birch bark- wood- metal- plastic tubing.

The first step to tapping a maple tree is to drill a 1.5-2 inch deep hole in the tree. Then, a spile is pounded into hole to allow the sap to flow out and down into the collection vessel (usually a bucket or plastic bag). A typical maple tree produces 5-15 gallons of sap each spring. Even the most sugary sap is mostly water (it's about 98% water and 2% sugar). In order to make 1 gallon of syrup you need to boil 40 gallons of sap. Boiling the sap removes water, leaving behind a more concentrated, sweet syrup. At Wolf Ridge, we typically tap about 40 maple trees and we boil our collected sap on a wood stove to make maple syrup.

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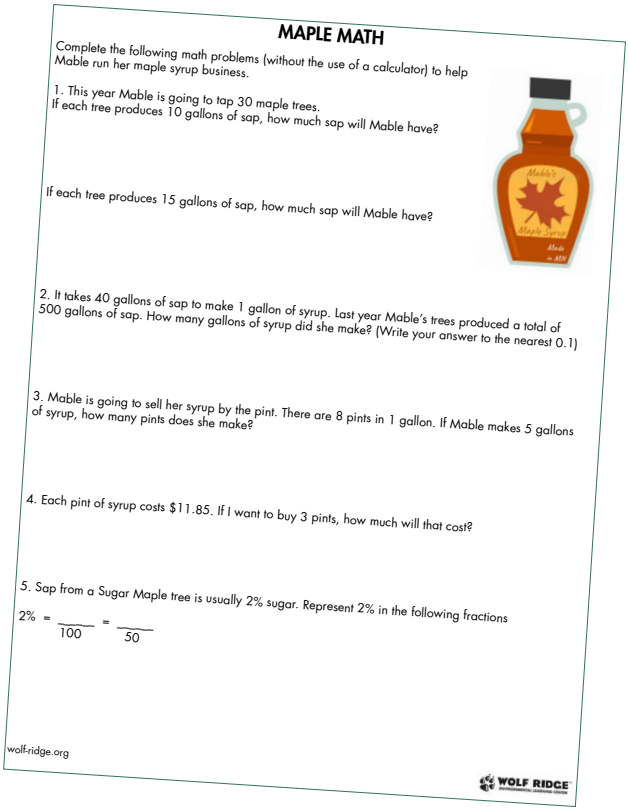
B. Maple Math

The Maple Math worksheet is in the appendix.



MAPLE MATH

Complete the following math problems (without the use of a calculator) to help Mable run her maple syrup business.

1. This year Mable is going to tap 30 maple trees.
If each tree produces 10 gallons of sap, how much sap will Mable have?

If each tree produces 15 gallons of sap, how much sap will Mable have?

2. It takes 40 gallons of sap to make 1 gallon of syrup. Last year Mable's trees produced a total of 500 gallons of sap. How many gallons of syrup did she make? (Write your answer to the nearest 0.1)

3. Mable is going to sell her syrup by the pint. There are 8 pints in 1 gallon. If Mable makes 5 gallons of syrup, how many pints does she make?

4. Each pint of syrup costs $11.85. If I want to buy 3 pints, how much will that cost?

5. Sap from a Sugar Maple tree is usually 2% sugar. Represent 2% in the following fractions

$2\% = \frac{\quad}{100} = \frac{\quad}{50}$

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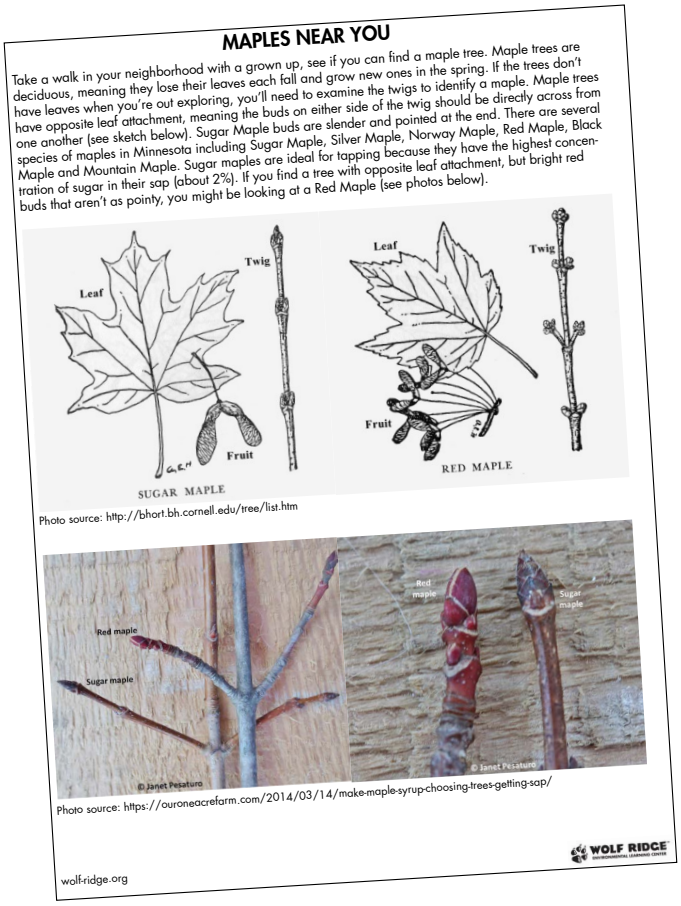
Maple Math Answer Key

1. 300 gallons of sap
   450 gallons of sap
2. 12.5 gallons of syrup
3. 40 pints
4: $35.55
5. 2% = 2/100 = 1/50

Maples Near You

The Maples Near You worksheet in the appendix.



MAPLES NEAR YOU

Take a walk in your neighborhood with a grown up, see if you can find a maple tree. Maple trees are deciduous, meaning they lose their leaves each fall and grow new ones in the spring. If the trees don't have leaves when you're out exploring, you'll need to examine the twigs to identify a maple. Maple trees have opposite leaf attachment, meaning the buds on either side of the twig should be directly across from one another (see sketch below). Sugar Maple buds are slender and pointed at the end. There are several species of maples in Minnesota including Sugar Maple, Silver Maple, Norway Maple, Red Maple, Black Maple and Mountain Maple. Sugar maples are ideal for tapping because they have the highest concentration of sugar in their sap (about 2%). If you find a tree with opposite leaf attachment, but bright red buds that aren't as pointy, you might be looking at a Red Maple (see photos below).

Leaf Twig Fruit SUGAR MAPLE

Leaf Twig Fruit RED MAPLE

Photo source: http://bhort.bh.cornell.edu/tree/list.htm

Red maple Sugar maple © Janet Pesaturo

Red maple Sugar maple © Janet Pesaturo

Photo source: https://ouroneacrefarm.com/2014/03/14/make-maple-syrup-choosing-trees-getting-sap/

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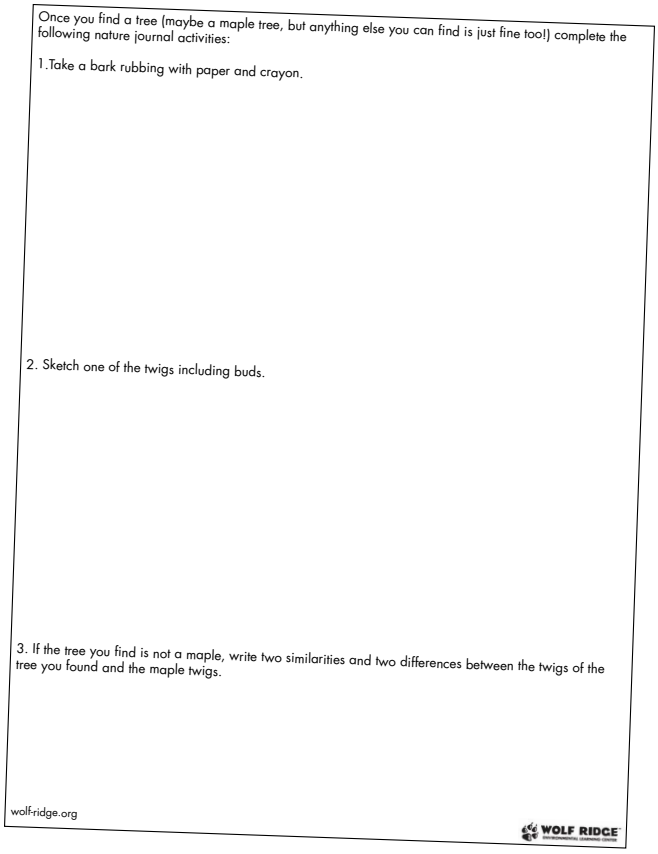

Once you find a tree (maybe a maple tree, but anything else you can find is just fine too!) complete the following nature journal activities:

1.Take a bark rubbing with paper and crayon.

2. Sketch one of the twigs including buds.

3. If the tree you find is not a maple, write two similarities and two differences between the twigs of the tree you found and the maple twigs.

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Appendix

Resources

The future of maple trees in Minnesota is uncertain. As the climate changes so too will the ranges of tree species including the Sugar Maple. The following article outlines some of the changes we might expect to see in the coming years: https://www.threeriversparks.org/page/climate-change-and-maple-trees

At Wolf Ridge, maple syruping is done on a very small scale. If you'd like to see what maple syruping looks like on a much larger scale, check out this video: https://www.youtube.com/watch?v=NV0RrD7ZE4Q

MN Standards

5th Grade Mathematics

- 5.1.1.1, 5.1.1.4, 5.1.2.4, 5.1.3.1

Worksheets

- Maple Story
- Maples Near You
- Maple Math

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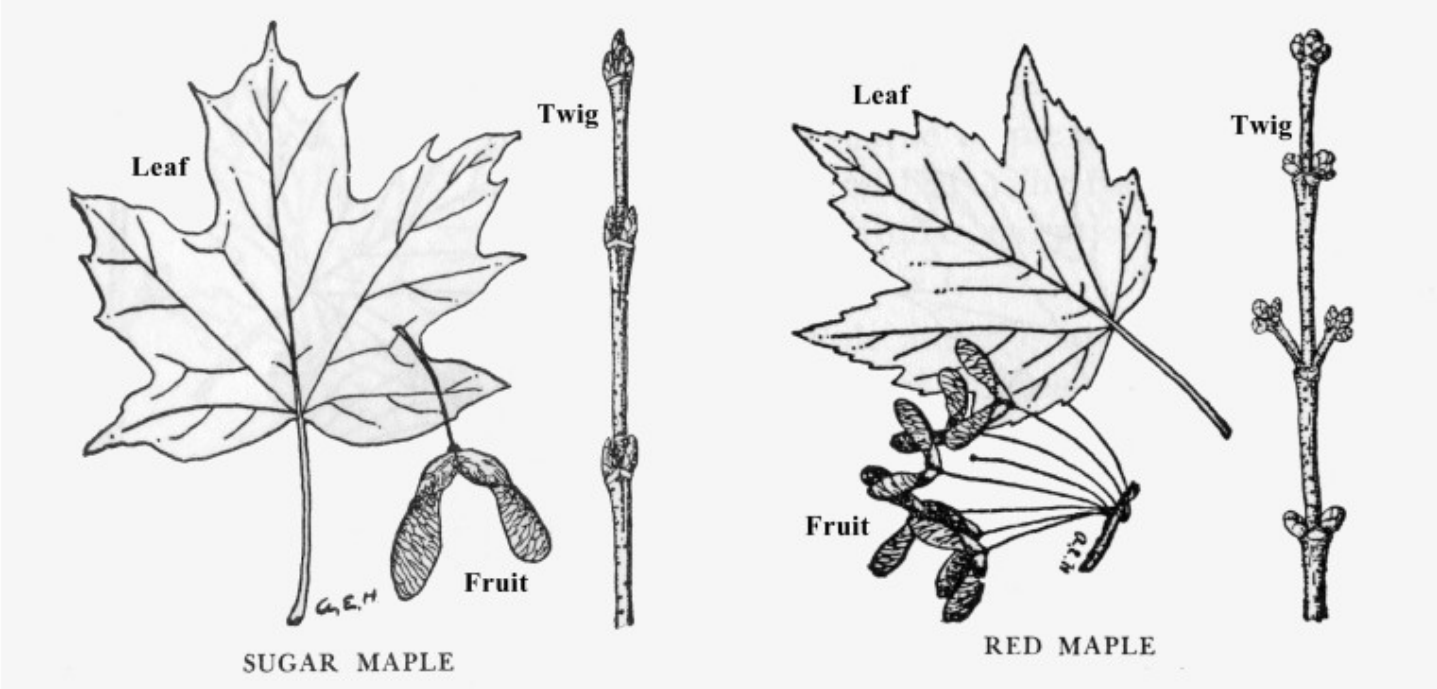

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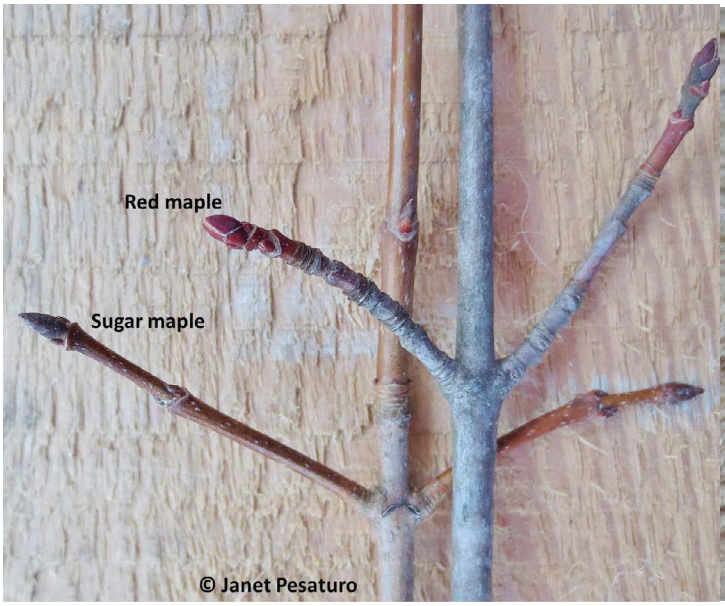

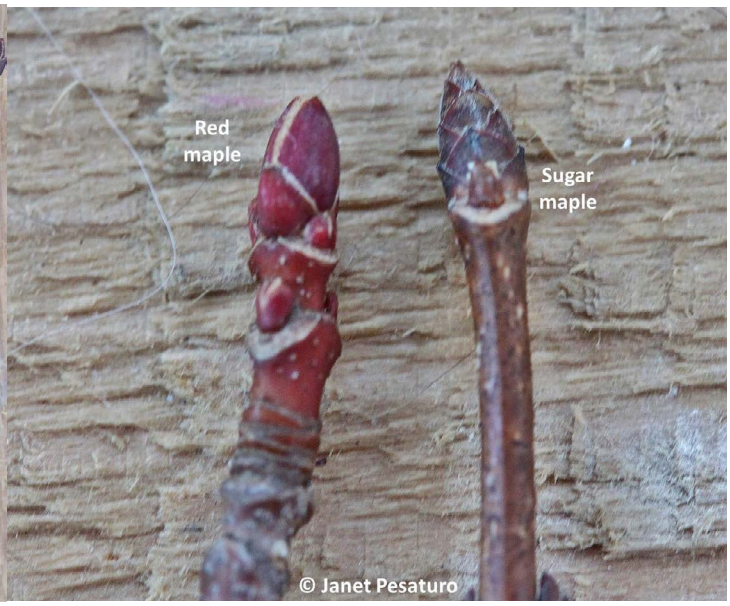

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