

Home School Series: 6 & Up

February: Maple Syruping

Start Up: Syruping tools, tree posters, maple twigs, map of North America
(5-10 min) Examples/pictures of maple products

Welcome/ Staff/Volunteer Names
Introduction: **Today's Topic-Maple Syrup Making**
1 min. **Question: What does it take to produce maple syrup?**

Opener: **Maple Syrup Matching** (see below)-
10 min. Give each student a card with a syruping-related word on it.
♣ Encourage discussion between students on which cards match.
♣ Ask each pair to announce their word match and tell the relationship between words.
♣ Have them make the matches without using the explanations on the back of the cards.

Background/ **History of Maple Syruping**-Tell a Native American syruping legend (Caduto).
Exploration: Describe the various traditional forms of maple sugar:
60 min. **Grain sugar**-Loose crystals formed by stirring thickened sap until cool
Cake sugar-Formed by cooling thickened sap into a mold, easy to store
Wax sugar-Syrup poured onto snow that cools into a chewy candy

Maple syrup is maple tree sap boiled down to 1/40th of its original volume.

Share about pioneer/settler adoption and adaptation of sugaring methods.
Learned how from the Native Americans, then used technology they had to speed the process, which went much faster with metal pots.

Pioneer/Settler methods-

- Drilled hole in tree trunk with metal brace & bit
- Used metal pots and tools, carved wood (and later metal) spiles (spouts)
- Collected sap buckets with horses or oxen
- Built sugar houses for protection from weather
- Blown bubble through twig loop test for doneness
- Mostly made sugar, which stores longer
- Traded metal containers & tools to Native Americans for sugar, etc.

Geography of Syruping-Sap only runs sweet under the right weather conditions, which occur in the Northeast U.S. and Canada. Europeans took maples back to the old country to try it, but were unsuccessful. Show a map of NE U.S. and Canada.

Activity: **Syrup Math**-Based on 40 gallons of sap for one gallon of syrup and an average of 10 gallons produced per tree, how many maple trees would you need to produce 10 gallons of syrup in one season? (see Lockhart for more math problems)

Parts of a tree-Review the crown (leaves), trunk, & roots with students.
Describe secondary growth and tree trunk anatomy, using tree cookies and a poster (see *K-2 Maple Syrup Time* for specifics).

Sap production-Describe photosynthesis and the sugars produced, and how they are stored in the tree roots in the fall/winter. Describe water flow in a tree.

Ask students why maple tree sap is sweet in the spring.

The stored sugars in the dormant tree make sap taste sweet.

Sap runs during times of freezing nights and warm 40-50°F days in the early spring.

(The actual “why” of sap flow remains somewhat a mystery.)

It’s a good idea to identify and mark your trees in the fall when they have leaves.

- ♣ Show the students a maple twig and a poster of a maple tree with leaves.
- ♣ Discuss features important to identification of maples.
- ♣ Note the different leaves of a Box Elder, and its special identification problems.

Maple tree identification basics-

- Maple trees have leaves and twigs in pairs on the twigs/branches.
- Maple tree leaves have several pointed lobes, and leaf veins radiate out from a central point.
- There are several species of maple tree-Sugar, Silver, Box Elder, Norway, and Red.
- The Box Elder (Ash-leaved maple) has three leaflets, not the typical Canadian flag type maple leaf. (trifoliolate/divided leaves)

Sugar Content-

- Sugar maples, the preferred trees for syruping, have the highest amount of sugar in their sap.
- Red Maples and Box Elders have less sugary sap, so it takes longer to boil down to syrup.
- Norway Maples and other ornamental maples have milky sap, and are unsuitable for tapping.
- In Iowa, Silver Maples and Box Elders tend to be numerous along streams & rivers.

They are a good source of sap when using existing trees.

**Prepare to
go Outside:**
5 min.

Restroom break. Dress for weather.

Bring: Tapping supplies

Trail Rules (see The First Program).

What we will do-Find areas where maples naturally grow.

Learn about how to manage and maintain a healthy sugar bush.

**OUTDOOR
EXPLORATION:**
70 min.

Hike through a floodplain or forest and practice identifying various maple species. Where are maple trees abundant?

Walk into a sugarbush or area thick with maples and discuss management for syrup production. (thinning trees, planting saplings, clearing brush, etc.)

Discuss the signs of the beginning of sap flow/syruping season:

- Crows cawing
- Warmer weather
- Melting ice and faster flowing streams
- Trees dripping sap from broken branches (sapsicles).

Time to clear a path through snow, and clean out dead brush, branches.

Activity:

Tap a Tree-Encourage students to tap a maple tree.

- ♣ Take turns drilling the hole for the spile with the brace and bit (angle up a bit).
- ♣ Clean the wood shavings out of the hole with a bent piece of wire.
- ♣ Let a couple students tap the spile into the hole with a hammer.
- ♣ If the sap is running, taste it by letting it drip onto a finger.
- ♣ Hang the bucket on the spile hook.

Tapping rules-

- Don't tap near old tap holes
- Tree needs to be 10" or more in diameter
- Tapping on the south/sunny side of the tree will give you more sap

Discuss & show modern methods of syruing-plastic tubing, pipelines, etc.

Visit or show pictures of a **sugar house** where sap is boiling.

An **evaporator**, or arch, has channels for heat flow, and more surface area than a cauldron.

Help the students learn about boiling and finishing techniques:

- Skim foam off the boiling sap with a strainer spoon.
- Check the density with a hydrometer or look for sheeting off a spoon.
(For home boiling, a candy thermometer will read 219°F.)
Syrup will spoil if not boiled enough, crystallize if boiled too long
- Strain/filter sugar sand/niter out of the syrup, then finish in a smaller boiler.
- Grade the syrup by checking its color (compare with a grading kit).

Discuss & show pictures of what would be needed to produce maple syrup for sale:

The syrup needs to be boiled to the right density, filtered, graded, and hot-packed at a temperature of at least 180°F in sterile containers.

Syruping equipment can be very simple, or more complicated for producing large amounts (see table below).

Discuss the end of syruing season, duties and cleanup of equipment:

The sap has a yellowish tinge, and/or doesn't taste sweet anymore.

This is called tasting "buddy" (tree buds are opening, sugars being used up).

Spring peepers begin calling, snow melts, sap stops dripping.

Time to clean buckets, spouts, and/or tubing.

Wash out evaporators and storage tanks.

Equipment needs to be clean and in good condition for next year.

Maple sugar products that can be made:

Maple Syrup-Boiled to the proper density, then poured into containers. Stays liquid.

Maple Candy-Syrup is boiled to 237°F and cooled, stirred, and poured into molds. Solid with a creamy texture.

Hard Maple Sugar-Syrup is cooked to 248°F, stirred, and poured into containers. Solid sugar is easily stored for later use. One of the original Native American products.

Maple Cream-Syrup is heated to 232°F, cooled to room temperature, stirred, and stored. Stays soft and is used as a spread or frosting (with added milk).

Indian Sugar-Heated to 45°F above boiling, stirred vigorously until cool.

Makes a granular sugar. The other common Native American and pioneer product.

- Game:** Play a game of the students' choice.
See *K-2: Maple Syrup Time* for a just for fun maple syruping game.
- Closing:** Give the students a taste of pure maple syrup or another maple product.
Tell students where they can find out more about maple syruping (websites, etc.).
- Send Off:** Goodbye!
Next Month-Soil Conservation
- Take Home:** Parent Outline
Maple syrup recipes
Syruping crossword or wordsearch

Vocabulary

Sugarbush, spile, cambium, heartwood, sapwood, xylem, phloem, dormant, opposite, alternate, hydrometer, evaporation, tap, mokuk, photosynthesis, brace & bit, arch, yoke, grain sugar, wax sugar

Background and Activity References for Naturalists and Parents

- <http://www.extension.umn.edu/distribution/naturalresources/DD1067.html> backyard syrup basics
- <http://www.extension.umn.edu/distribution/naturalresources/DD6286.html> Maple tree identification
- www.forestry.iastate.edu/ext/pubs/F-337.pdf Syrup production in Iowa
- www.goshen.edu/merry/ea/sugar/physics.htm Physics of syruping
- <http://members.iquest.net/~childers/maple/hist.html> History of syruping
- Search "maple syrup" on the internet for lots more information on how-to, recipes, & products

- Caduto, M. J., and J. Bruchac. 1989. *Keepers of the Earth: Native American Stories and Environmental Activities for Children*. Fulcrum, Inc. Golden, CO. P. 145 Manabohzo and the Maple Trees
- Corbin, Devin, "Twilight of the Sugar Maples", *Utne*, LENS Publishing Co., Inc. Sept/Oct. 2004, pp. 36-41.
- Frost, Frances. 1950. *Maple Sugar for Windy Foot*. McGraw-Hill, NY.
From a series told from a New England farm pony's perspective.
- Glatz, Richard. 1978. *Teacher's Guide to Maple Syruping Programs*. Riveredge Nature Center, Ashland, WI.
- Gokay, Nancy Hatch. 1980. *Sugar Bush-Making Maple Syrup*. Hillsdale Educational Publishers, MI.
Photos of syruping process and recipes
- Hauser, Susan C. 1997. *Sugartime: The Hidden Pleasures of Making Maple Syrup*. The Lyons Press, NY.
- Lockhart, Betty Ann. 1990. *The Maple Sugaring Story*. Vermont Maple Promotion Board, Charlotte.
Pp. 11-12 Pure Maple Products; p. 23 Syruping steps; describes the sugaring process; includes activities for all students; photos and diagrams of syruping and equipment
- Making Maple Syrup: A Beginner's Guide*. 1980. Garden Way Bulletin A-51. Garden Way Publishing, Charlotte, VT. Description of syruping process and how-to for three different levels of production.
- Mann, Rink. 1978. *Backyard Sugarin'*. The Countryman Press, Woodstock, VT.
Many photos of equipment for small-scale syrup production
- Sloane, Eric. 1962. *Diary of an Early American Boy*. Ballantine Books, NY.

To make Maple Syrup you need:

The right climate-New England into the Midwest.

Freezing nights and warm (40°+) sunny days in late winter/early spring (Late February through March).

Maple trees at least 10" in diameter.

Tree tapping and sap collecting equipment (drill, spile/tap, bucket).

A stove/fire and large kettle or flat pan to boil down sap into syrup.

Containers to store the syrup in.

Extensions/Alternate Activities/Rainy Day

Describe the Native American method of making maple syrup: slashed tree trunk with an ax, collected sap in birch bark containers, boiled it down in a hollow tree trunk by using hot rocks or in bark or skin containers suspended over coals (see *K-2 Maple Syrup Time*).

Maple Sugar politics-Discuss with students how Northeastern colonists took pride in making their own sugar cheaply rather than buying expensive imported cane or beet sugar. Abolitionists also objected to those imported sugars due to their use of slave labor in their production (Lockhart).

Syrup became more popular as a maple product after 1885, when the high tariffs were removed from cane sugar imports (Lockhart).

Discuss careers in and related to the maple syrup industry-crafters of sugaring supplies and evaporators, scientists/researchers studying maple trees and their diseases, & maple product sales.

Make Sugar on Snow or Jack Wax-

- Use an ice shaver to fill a cake pan or two with "snow". Pack it down a bit.
- Keep snow in a freezer or outside until ready.
- Boil 1-1/2 pure maple syrup on medium heat, stirring frequently, to 232°F (Soft Ball stage).
- The syrup will try to boil over; a bit of butter/fat added in will keep it tame.
Spoon or carefully pour blobs of hot syrup onto the shaved ice "snow".
- Let the syrup cool a couple minutes and eat.
- This takes a long time and is messy, but worth it.

(If left in the snow after it's cooled, the candy will start getting runny.)

Have students make a spile out of a sumac twig section to take home. Push the pith out of a 2-1/2 – 3" piece and whittle one end to taper it.

Invite a maple sugar producer to visit the program.

Supplies:	<ul style="list-style-type: none"> Tree poster showing secondary growth Tree cookies and/or a model of a tree trunk Poster of tree parts Poster with maple trees Maple twigs, alternate twigs for comparison A Native American syruing legend A map of North America 	<ul style="list-style-type: none"> Maple Syrup Matching cards Maple products-syrup, candy, etc. Paper Pencils Pictures of syruing equipment Pictures of a sugar house and evaporator Hydrometer or picture
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Tree tapping-	<ul style="list-style-type: none"> A drill or brace & bit (7/16") Hammer Sap collecting spout (spile) A bent piece of wire A sap collecting bucket or bag A 12" ruler to gauge tree size A bucket to carry supplies in A large (10" + diameter) maple tree (A fairly fresh cut log on end can be substituted) 	<ul style="list-style-type: none"> Ice cream or shaved ice to hold a taste of maple syrup See table below for boiling materials
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Advance Preparation:

Copy cards for **Maple Syrup Matching**.

Assemble necessary equipment for tree tapping.

Prepare a maple syruing legend to tell students (Caduto).

It is a good idea to have another person boil the syrup down for sugar on snow. Ice can be shaved and packed ahead of time.

Options for producing maple syrup (Garden Way):

Complexity	# of trees/taps	Amount of Syrup	Equipment	Cost
Level 1	1-5	1-3 quarts	spiles Hand drill 7/16" bit (1/2") clean milk jugs or buckets outdoor fire or wood stove	\$10.00+
Level 2	12	5-10 gallons	spiles Hand drill & 7/16" bit covered sap buckets or bags large flat-bottomed pan outdoor fire or wood stove hydrometer skimmer filter (paper) grading set syrup containers	\$300.00+
Level 3	60-200	15-50 gallons	spiles drill & 7/16" bit covered sap buckets or bags sap evaporator sugarhouse hydrometer skimmer filter (felt) grading set syrup containers	\$2000.00+

Maple Syrup Matching cards-

BRACE
XYLEM
HAMMER
SUGAR STORAGE
SUGAR HOUSE
FIRE WOOD
PHLOEM
HYDROMETER
BIRCH BARK CONTAINER
MAPLE SUGAR

BIT
SAP
SPILE
TREE ROOTS
EVAPORATOR
ARCH
STARCHES & SUGARS
TESTING FOR DENSNESS
GALVANIZED BUCKET
NATIVE AMERICAN SWEET

Maple Syrup Matching cards-

the sharp boring part of a hand drill

liquid flowing up from the roots

spout which directs sap flow

below-ground parts of the tree

equipment which boils sap into syrup

firebox under the evaporator

products of photosynthesis

check if the sap is dense enough

a sturdy and long-lasting metal sap collector

have some form of sugar energy in early winter

The handle that turns

Hollow tree trunk cells which carry

Used to tap in the

Happens during winter in the

Keeps heat from escaping around the

Fuels the fire in the

Living cells which transport down the

A tool that floats in boiled sap to

Original sap collector later replaced by

The reason people first collected & boiled sap to

