



Lesson Plans for the Maple Sugaring Process

Key Words: Sap, spile, cheesecloth, evaporator (evaporation), reverse osmosis, ratios, hydrometer/hydrometer test cup, temperature, boiling point, freezing point, habitat, yield, Baume Scale, weather forecasts, sugaring, natural resources, grading of maple syrup

Lesson Plan Grade Level: Can be adapted for third grade through High School

Goals for the Lesson:

- Students will explore the steps of the maple sugaring process
- Students will appreciate earth's natural resources
- Students will learn the history and progression of the sugaring process
- Students will utilize teamwork, math, science and research skills
- Students will learn the process of evaporation

Learning Objectives:

1. Students will describe and discuss temperature fluctuations and the impact on sap flow
2. Students will define the boiling point and freezing point of sap
3. Students will explain the concept of ratios – 40 to 1 ratio
4. Students will define evaporation
5. Students will learn to recognize a maple tree and study its habitat
6. Prepare database for collected data to be stored year after year for comparisons
7. Explore ways to reduce our carbon footprint
8. Promote Nature and the care for it

Equipment for Sap Collection:

- Sugar Maple Tree – a healthy tree at least 12 inches in diameter
- Drill with 7/16 drill bit
- Spile/hook
- Bucket/lid
- Cheesecloth
- Hammer
- Pliers
- Access to weather/temperatures

Equipment for Sap Storage:

- Food Grade Containers

Equipment to Make Syrup:

- Maple Sap
- Heat Source
- Pot (large and small)
- Filter
- Candy Thermometer
- Hydrometer (optional)
- Hydrometer Test Cup (optional)
- Finished Product Container (jar and lid)
- Refrigerator storage for sap

Research:

- Who were the first to tap maple trees?
- What types of trees can be tapped? Results
- What are some of the uses for maple sap?
- What are the necessary steps of the maple sugaring process?
- Review basics of weather/historic area temperatures
- Origins/history of maple sugaring
- Habitat of Maple Trees
- Explore effects of global warming
- Promote Nature and the care for it
- Explore ways to reduce our carbon footprint
- Research the modes of transport from tree to consumer

Technology effects on sap collection/syrup distribution

1. Impact of tubing collection system on trade.
2. Changes in fuel source – wood/ fuel oil
3. Direct to market place
4. Communications impact
5. Distribution channels
6. Explore effects of global warming

Uses of Maple Sap Options:

- Make syrup
- Make maple sugar
- Drink sap straight from tree
- Pour syrup over snow and eat!

Timeline:

Fall/Early Winter

- Identify Maple Trees utilizing Maple Sugaring at Home book and/or online resources
- Utilize online resources and Google Earth to explore different types of maps ie: topography
Compare/contrast
- Review basics of weather

January/February

- Access weather/temperatures
- Discuss impact of temperatures on sap flow
- Discuss origins of maple sugaring
- Use links to weather maps and satellite photos to predict weather/compare to actual forecasts
- Learn the process of collecting sap
- Track high/low temperatures utilizing www.noaa.gov

Late February/Early March

- Gather all Equipment
- Clean Supplies
- Conditions warrant Tap Trees
- Collect and Store Sap Prior to Boiling
- Record data
- Graph Results (Excel)
- Boil Sap into syrup/sugar

Late March/Early April

- Pull Taps
- Present Information Gathered
- Clean all Equipment

Class Participation:

Set up tasks for each student. Students can work independently doing one of the following:

- Weatherperson -Record temperatures
- Maple Tree locator
- Spile insertion
- Sap collector
- Filter sap through cheesecloth
- Fire source preparer
- Boiler
- Filter syrup
- Data collector
 - measuring all quantities
 - preparing ratios
 - impact of temperature on sap flow
- History of maple syrup production
- Chart progress/record events
- Graph impact of temperature on sap flow
- Make Predictions

ART

- Take photographs
- Draw pictures of trees/leaves
- Bark rubbings – charcoal
- Trace leaves
- Sponge paint leaves
- Create maps of area locating maple trees

Language Arts/Writing

- Write a journal of your experience
- Create graphs charting progress
- Create recipes utilizing maple sap/syrup
- Write letter to Senator promoting maple sugaring
- Contact your local sugar shack

Field Trip to Sugar Shack

Math

- Explore concept of ratios:
 - Sap to syrup ratio 40 to 1
- Graph relation temperature changes/sap yields
- Weight of sap/syrup

SCIENCE

- Explore concept of evaporation
- Learn how to read temperature, distinguish between Fahrenheit and Celsius
- Learn boiling point/freezing point
- Utilizing hydrometer cup and hydrometer (Baume scale) measure the density of liquid
- How is sap produced in nature?
- Explore the process of sap to syrup and syrup to sugar
- Learn tree species

HISTORY

- Native American Indians taught early settlers about maple syrup production
- By 1680, European settlers and fur traders were involved in harvesting maple products.
- During the 17th and 18th centuries, processed maple sap was a source of concentrated sugar, in both liquid and crystallized-solid form
- The first evaporator, used to heat and concentrate sap, was patented in 1858. In 1872 an evaporator was developed that featured two pans and a metal arch or firebox, which greatly decreased boiling time.
- Around 1900, producers bent the tin that formed the bottom of a pan into a series of flues which increased the heated surface area of the pan and again decreased boiling time
- During the 1970s, a large number of technological changes took place. Plastic tubing systems which had been experimented with since the early part of the century were perfected, and the sap came directly from the tree to the evaporator house. Vacuum pumps were added to the tubing systems. Pre-heaters were developed to recycle heat lost in the steam. Reverse osmosis machines were developed to take a portion of water out of the sap before it was boiled.

Resources

Maple Sugaring at Home book (ISBN 978-0983125600)

<http://www.tapmytrees.com>

<http://maple.dnr.cornell.edu/>

<http://www.noaa.gov>

http://en.wikipedia.org/wiki/Maple_syrup

<http://www.sciencenewsforkids.org/articles/20070314/Feature1.asp>