MINING FOR CHOCOLATE

(Adapted activity from Population Education Program.Org, Counting on People: Activities for Global Citizenship, Mining for Chocolate Activity, Washington DC, USA, Population Connection, 2016)

LEARNING OBJECTIVES:

- Identify the difficulties of mining minerals from the Earth and observe possible impacts to the environment
- Use observation skills and make an estimates
- Describe how mining operations can affect the land, water, animal habitat and other natural attributes
- Examine the opportunity costs associated with full-scale mining operations and name two examples
- Match everyday items with the minerals from which they are made

CONCEPT: Non-renewable resources are mined from the Earth to meet the wants and needs of humans and as a result there are often damaging impacts to the land, water, animal habitat and other natural attributes.

GRADE LEVELS: Upper Elementary and Secondary Cycles

SUBJECTS: Science, Math, Social Studies, Geography, Environmental Awareness

SKILLS: Estimating, making connections, fine motor skills, brainstorming

MATERIALS:

(Part 1)-Mineral Matching Activity:

- Student Worksheet provided below
- Teacher Answer page provided below

(Part 2)- Hands-on Mining Activity:

- Hard chocolate chip cookies (1 per student)
- Toothpicks
- Forks
- Napkins
- Mining Area Grid Worksheet provided below

BACKGROUND INFORMATION: Many of the products we use every day ranging from plastic water bottles to wrist watches. crayons and headphone wires are all produced from rocks and minerals mined from the Earth. These rocks and minerals are considered a non-renewable resource because there is only a set amount of each and once it is used up, it will be gone forever. Some of these resources are very common and others are scarce. As the human population has grown, the demand for these resources has grown as well. Extracting rocks and minerals from the Earth is typically done by mining. Large scale mining operations are used all over the world and can often damage the land on which they take place. Unfortunately, the end result of mining (the profits made by selling the minerals) can at times overshadow the damage done by the process which includes destroying animal habitat, clear cutting of trees, pollution of local streams, soil and water supplies etc.).

PART 1: MINERAL MATCHING ACTVITY:

PROCEDURE

Step 1. To get students thinking about how humans depend on mined rocks and minerals, distribute copies of the Student Worksheet and have them fill it out. The worksheet asks students to match up some common household items with the rocks/minerals from which they were made. After students have completed the worksheet, go over it as a group.

Step 2. Ask students to name some items which they enjoy using. This might include television, computer games, MP3 players, certain toys, and appliances. After listing their suggestions on the board, have the students brainstorm as a class what elements from the ground, perhaps some that were on the worksheet, may have been used to produce each item. For instance, electronic equipment may have a plastic shell (a petroleum product), copper wiring, etc. Some of them may be obvious, others they may have to look up. You could extend this as a library activity for finding out some of the answers.

STUDENT WORKSHEET ANSWERS: (MINERAL MATCHING ACTVITY)

1.E; 2.L; 3.M; 4.P; 5.D; 6.N; 7.A; 8.B; 9.O; 10.K; 11.C; 12.H; 13.F; 14.Q; 15.J; 16.G; 17.I

PART 2: HANDS-ON MINING ACTIVITY

PROCEDURE

Step 1. Distribute the cookies to the students (but they must not eat them!). Explain that the cookies represent the land and the chocolate chips represent a mineral, like coal, which they will be mining from the cookie. With the cookie flat on the desk, and without picking it up, ask students to estimate the number of chips in their cookie.

Step 2. Distribute a copy of the Mining Area Grid to the students. Explain that the images on the grid represent various attributes of the environment where they'll be mining. Students should place the cookie on the grid and, using a pencil, trace the outline of the cookie.

Step 3. With their toothpicks and forks, students will attempt to extract the chips from the cookie. Cookies should stay flat on the paper (in the real world, you can't pick up the earth and dig from the bottom!). After a few minutes of mining, ask students if they wish to change their estimate of how many chips are in their cookies.

Step 4. After students have finished mining their cookies, have everyone outline the area on their grid paper that is covered by cookie crumbs. A rough estimate is fine; this doesn't need to be exact.

Step 5. Have the students share their experiences. What was their goal at the beginning of the activity? – to mine for as many chips as possible and/or keep the cookie intact? What was their mining strategy? Did they experience any difficulties? Do they think mining companies might have the same kinds of difficulties?

Step 6. Ask the students to count the number of chips they extracted. (Broken chips can be combined and counted as one chip.) Have the class look at the cookies of the students that extracted the most chips and the least amount of chips. Do the cookies look different? Do they see a connection between the amount of chips extracted and the state of the cookie?

Step 7. Now have the students "reclaim" the land. Using just the toothpicks and forks (no hands!) instruct them to try and get the cookie crumbs and pieces back inside the original circle. Is it difficult? Do they think reclaiming actual mined land would be difficult?

Step 8. Ask the students to count how many squares on their grid paper have any pieces of cookie in them. What Natural attributes are located in those squares? How many of each attributes have cookie bits in them?

DISCUSSION QUESTIONS:

1. Which mining approaches did the most damage to the Earth? This will be shown by which grid has the most natural attributes covered by cookie pieces as well as the most damaged cookie. Which mining strategies made the most money from their mining operations? (i.e. The students who extracted the most chips.)

2. We put a monetary value on the rocks and minerals mined from the earth. But, do we put a price on the natural attributes included on the grid and the services they provide – trees that provide oxygen, landscapes

that provide beautiful natural views, protecting habitat for animals, rivers and streams that provide water supplies etc.? Why not? Would it be possible?

Answers will vary.

3. What do you think it means when an attribute square on your grid has cookie on it?
Answer: That the specific natural attribute has been damaged or lost.
Thinking specifically about the water, does covering just one or two "water squares" with cookie impact just those two squares or does it impact additional squares?
Answer: It impacts all of the water squares downstream. The water is moving down the stream so pollution at any point will have an impact on the entire resource.

4. What about the squares that have been "reclaimed" – those located between the original circle and the new outline. Just because they're no longer covered by cookie, do you think that area is completely back to normal?
Answer: No. Even the reclaimed land will be different than it was originally.

When you first put your cookie down on the grid, did you consider what natural attributes you'd be covering? What was your reasoning for the cookie's placement?

Answers will vary. Some students may have tried to cover the least total natural attributes; others may have tried to cover a small amount of many types of natural attributes or mostly only one type. Alternatively, some students may not have thought about what was being covered.

5. Have students brainstorm ways to reclaim their cookies (put them back together). They might think to use frosting to stick the pieces together, or get the crumbs wet and mush them back together. But will the cookie ever be the same as it was?

6. Opportunity cost is the value of the next best choice that humans give up when making a decision. For example: If you choose to go see a movie, you cannot spend that time reading a book and you cannot spend the ticket money on something else. The opportunity cost of attending the movie is giving up the pleasure you would have had when reading a book and/or the money spent to purchase the ticket. The opportunity cost of using a resource is the value of any alternative uses of that same resource.

In regards to the cookie, what is the opportunity cost of "mining" your cookie and turning it into crumbs?
Answer: The opportunity cost is getting to enjoy eating the cookie as a snack.

MEASURING LEARNING

Review the Student Worksheet and have students write a journal entry about their experiences mining the cookies. Have them answer the following questions:

a. What was my original goal when I started mining the cookie? What difficulties did I have while mining my cookie?
b. If I were to mine another cookie, would I have the same goal? If not, what would my new goal be and why?
c. How is your experience similar or different than the goals and difficulties of real mining operations?
d. Give an example of a time when you had to make a choice. What did you choose to do and what was the opportunity cost of that choice?

FOLLOW-UP ACTIVITY

Because minerals are nonrenewable resources, they need to be conserved and recycled so that we don't run out of minerals that are in short supply. Select several of the minerals listed on the Student Worksheet and ask students to offer suggestions on how these elements might be conserved. For instance, tin and aluminum cans are often recycled as part of curbside recycling programs. Tin cans can be washed and reused as containers for pennies or paper clips. Gold can be melted down and redesigned for other uses. Aluminum cans can be remade, saving 95 percent of the energy used to make new cans from newly mined aluminum.

MINING FOR CHOCOLATE
STUDENT WORKSHEET

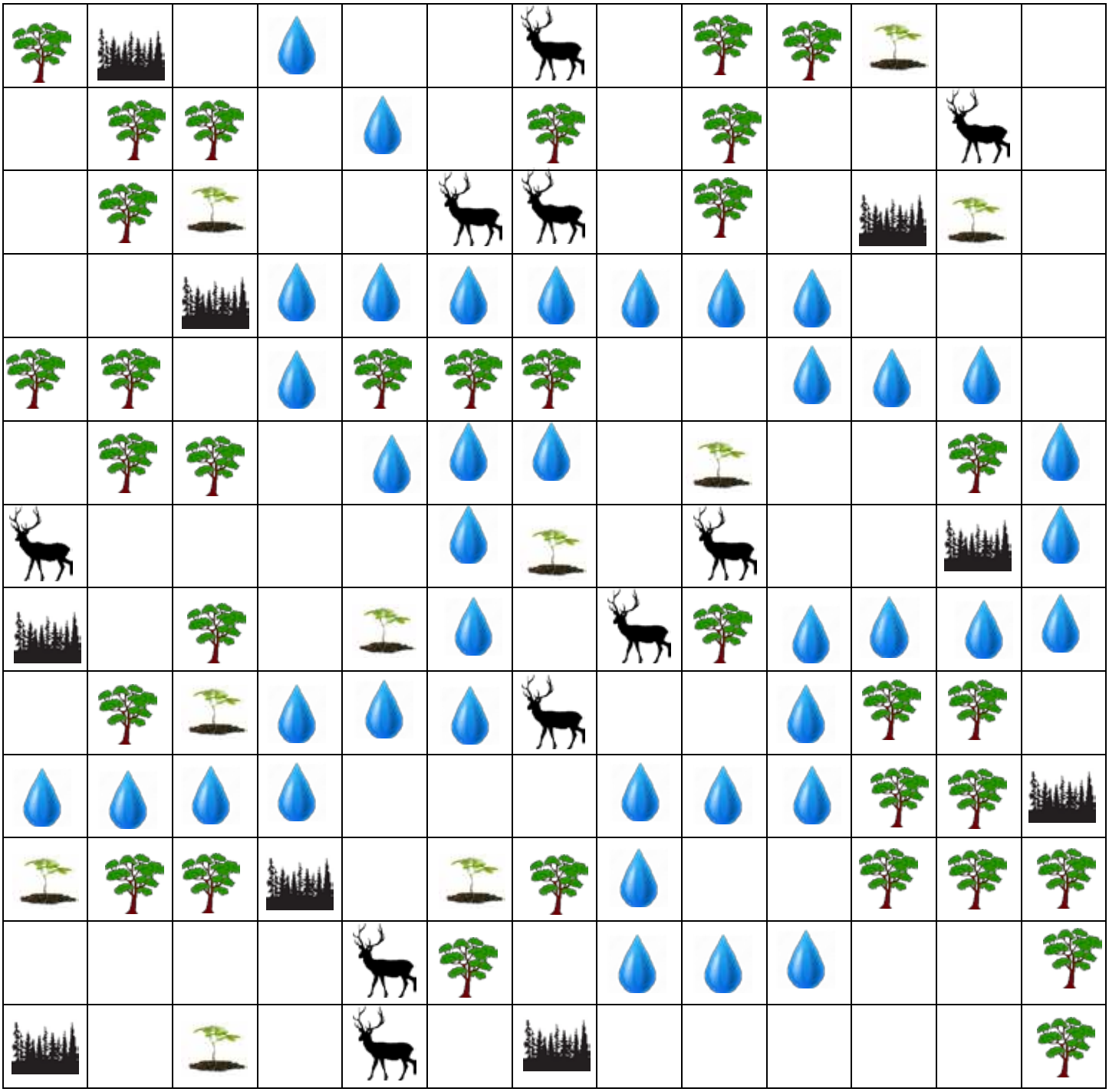
Name: _____ Date: _____

Everything listed below is produced using minerals mined from the ground. In the blank to the left of the items listed, write the letter of the element from which these items were made. The elements are listed at the bottom of the page.

1. _____ Soup cans
2. _____ Matches, gunpowder, rubber
3. _____ Watches, radios, televisions, radar instruments
4. _____ Pencil
5. _____ Bricks, pottery, tennis courts
6. _____ Pennies, stereo wire, brass instruments
7. _____ Wedding band, first-place medal, nuggets
8. _____ Soda pop cans, foil wrap, baseball bats, house siding
9. _____ Horseshoe, hammer, steel products (cars, nails, swords)
10. _____ Food seasoning and preserver
11. _____ Plastics, heating fuel, gasoline, vinyl, synthetic fabrics
12. _____ Old five-cent coins, paper clips
13. _____ Baby powder, crayons, soap
14. _____ Jewelry, drill bits
15. _____ Most common source of electricity in Canada
16. _____ Pipes, old paint, X-ray shields
17. _____ Flatware (forks, knives, spoons), jewelry, second-place medal

Minerals Mined From The Ground			
A. Gold **B. Aluminum** **C. Oil (Petroleum)** **D. Clay**	**E. Tin** **F. Talc** **G. Lead** **H. Nickel**	**I. Silver** **J. Coal** **K. Salt** **L. Sulfur**	**M. Quartz** **N. Copper** **O. Iron** **P. Graphite** **Q. Diamond**

MINING AREA GRID



Natural Attributes:

Water 

Tree 

Rich top soil 

Animal habitat 

Beautiful landscape 

"The 10 Tree Challenge"

Leaf Identification and Collection Activity

(Adapted activity from Marie-Claire La-Flair, 2004 The Leaf Hunter Scholastic Canada Limited, Markham, Ontario, Canada)

The Challenge: Identify, collect and mount samples from 10 tree species

Learning objectives:

- To develop knowledge of 10 local tree species
- To engage and develop observation skills of the learner
- To learn to identify the differences in deciduous (tree with leaves) and coniferous (tree with needles)
- To observe differences in leaf anatomy and structure with simple leaves and compound leaves
- To engage the learner in collection and preserving leaf samples from nature
- To recognize an important ecological concept such as diversity of tree species (Diversity: differences in living things allow for the success of all life)

Subject areas: Science, Ecology, Creative Arts, Environmental Awareness

Grade levels: Elementary and Secondary

Materials- Tree identification sheets (provided), collection bag, wax paper or parchment paper, craft glue, paint brush, construction paper for mounting samples

References:

La Flair, Marie-Claire, 2004 The Leaf Hunter, Scholastic Canada Limited Publishing, Markham, Ontario, Canada

Hosie, R.C., 1979 Native Trees of Canada, Fitzhenry and Whiteside Limited Publisher, Don Mills, Ontario, Canada

Petrides, George A, 1982 A Peterson Field Guide to Trees and Shrubs, Houghton Mifflin Publishing Company, Boston, USA

Small, Ernest, Catling Paul M. and Brooks, Brenda, 2012 Official Plant Emblems of Canada- Biodiversity Treasure Published by Public Works and Government of Canada, Ottawa, Ontario, Canada

1. How to prepare your leaf collection (it's easy!)

You will need:

– sheets of construction paper, folded in two to form a card (you will need one card for every leaf you press)

– two squares of corrugated cardboard, each one the same size as your cards (you can cut up an old cardboard box for this)

– an old phone book

Later, you will need:

– a paintbrush

– white glue

– wax paper

2. The hunt

Choose a good leaf with all its tips intact. It's easiest to gather according to species of tree, but if you find a leaf you like and you don't know what tree it belongs to, gather it anyway! You will always be able to place it later.

If the leaf you like has already fallen from a tree, make sure it is not completely dry (if it is, it will crumble in your leaf press).

If you want to pick a leaf from a tree, ask an adult for help. But remember: one or two leaves per species is enough. Trees need their leaves to eat and breathe, and you can hurt a tree if you take too many.

Also, don't take leaves from a tree on private property unless you have the owner's permission.

3. Pressing and drying your leaves

- carefully lay your leaf inside the construction paper card, making sure it doesn't fold over or crumple
- place your card between two pieces of cardboard
- lay the phone book over the cardboard
- be patient! Drying your leaves will take several days

4. Once your leaves have dried

The moment has come for you to paste the leaves in your book!

- remove the leaf from the card and carefully paint glue on the back of the leaf
- place your leaf on its matching page in this book
- cover the leaf with a sheet of wax paper and close the book (the wax paper will keep the pages of your book from sticking together)

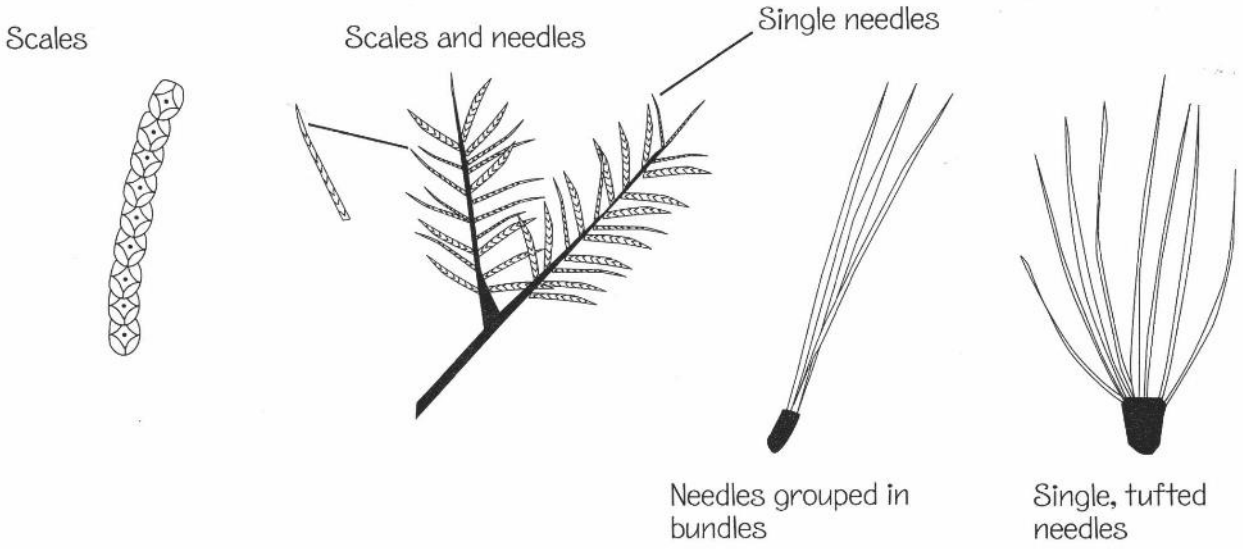
In a couple of hours you will be able to remove the wax paper and admire your leaf!

TIP: When you are out for a walk, carry a plastic bag with you so you can bring back the leaves you find along the way. You never know when you will find the leaf you're missing!

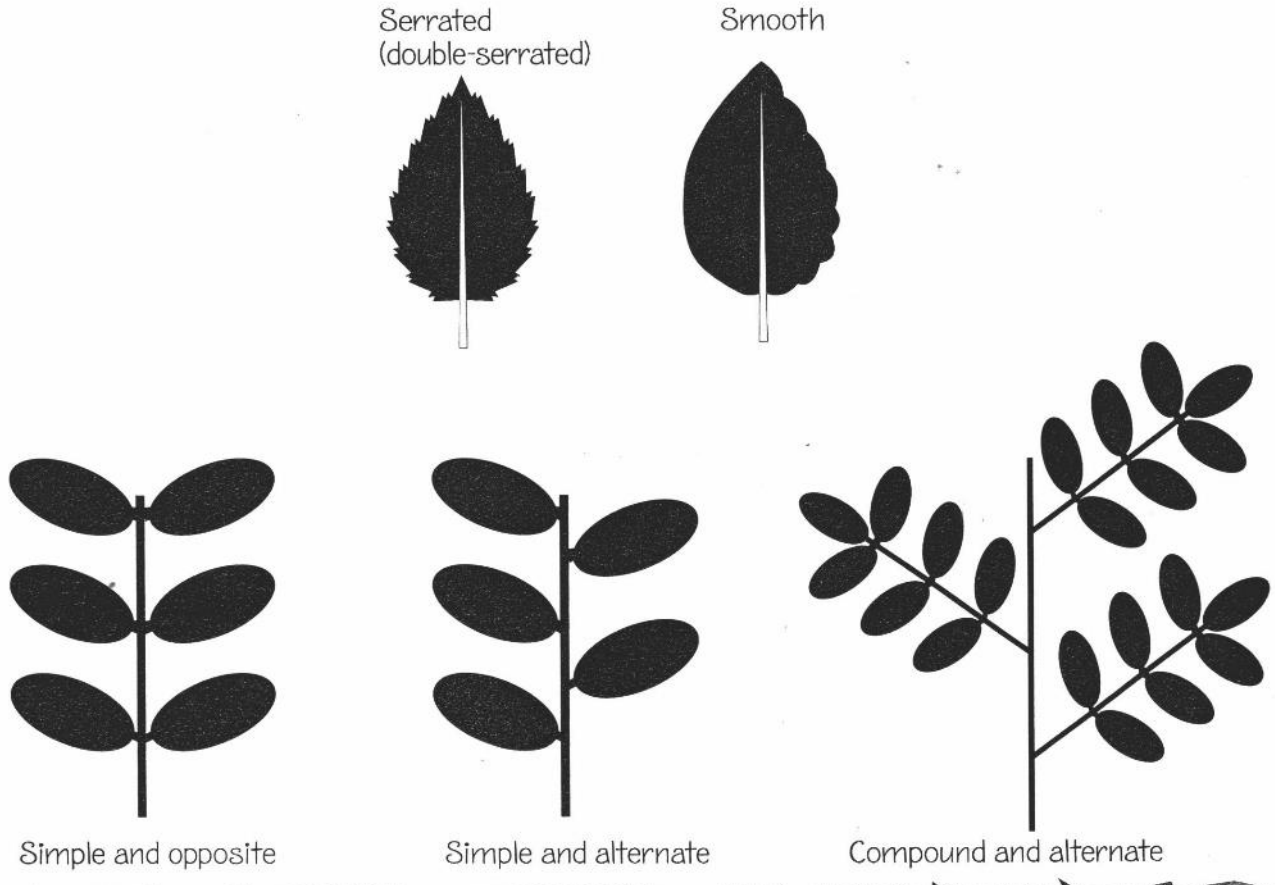
IMPORTANT: You must never, ever eat anything growing on a tree or bush without first asking your parents. Edible and poisonous berries can look a lot alike, so be careful!

THE ANATOMY OF A LEAF

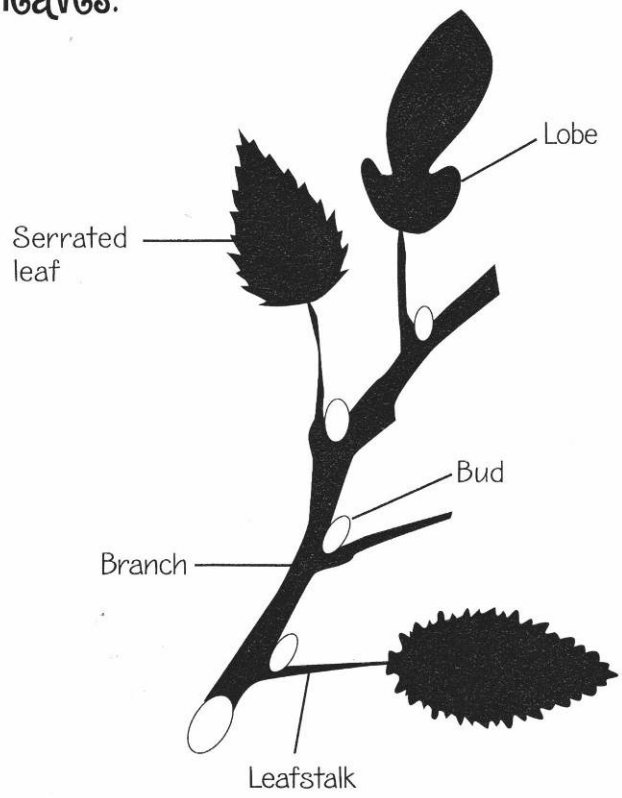
Coniferous trees:



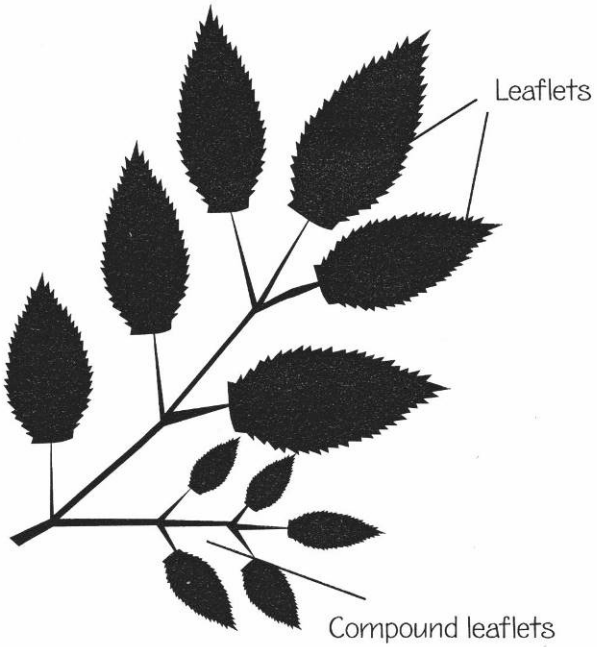
Deciduous trees:



Simple leaves:



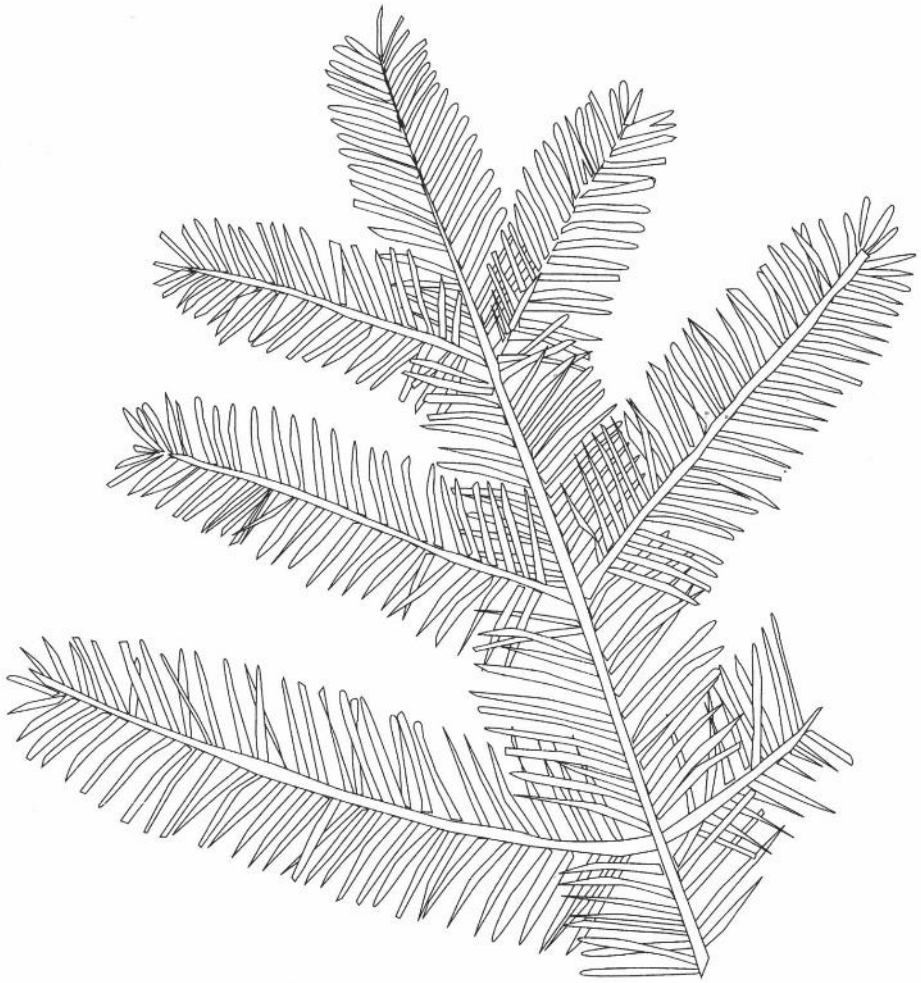
Compound leaves:



Balsam fir

Needles: The balsam fir has single, flat needles. They are arranged in flat sprays and you cannot make them roll between your fingers.

The balsam fir is the most popular type of Christmas tree.



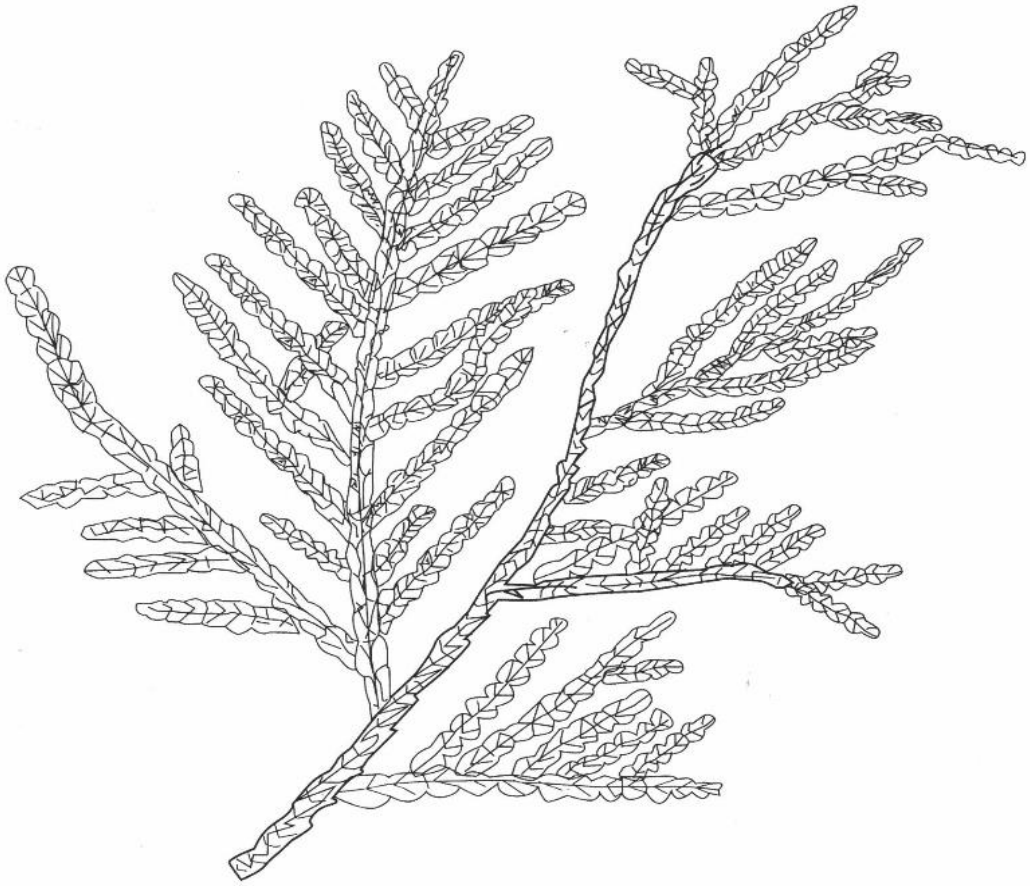
Balsam fir

Abies balsamea

Eastern white cedar

Needles: The eastern white cedar's needles are formed of tiny yellowish-green scales.

The eastern white cedar is one of the few coniferous trees whose needles are scale-like. It is also known as the northern white cedar.



Eastern white cedar
Thuja occidentalis

Eastern White Pine

Pinus strobus

It has skinny needles that are 6 to 12 centimeters long. It's easy to recognize because the eastern white pine grows its needles in bunches of five.

Sugar maple

Leaves: The sugar maple has simple, opposite leaves with three to five lobes with rounded tips.

The sugar maple's leaf is on the Canadian flag, and its sap is used to make maple syrup.

Sugar maple
Acer saccharum

Red maple

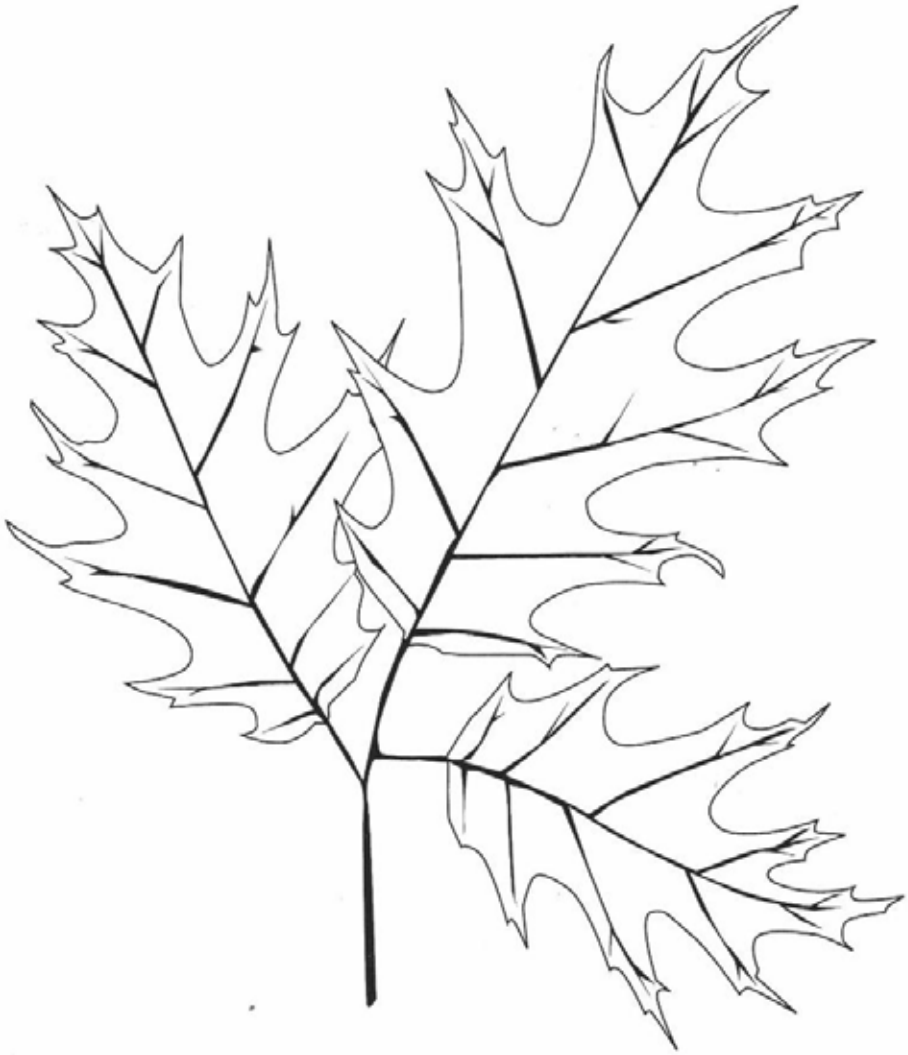
Leaves: The red maple has simple, opposite leaves with three to five lobes that are serrated.

The red maple gives sap that could be used to make maple syrup, but its flavour is more pungent and not as sweet as the sugar maple's.

Red maple
Acer rubrum

Red oak

Leaves: The red oak has simple, alternate leaves with very fine, needle-like tips.



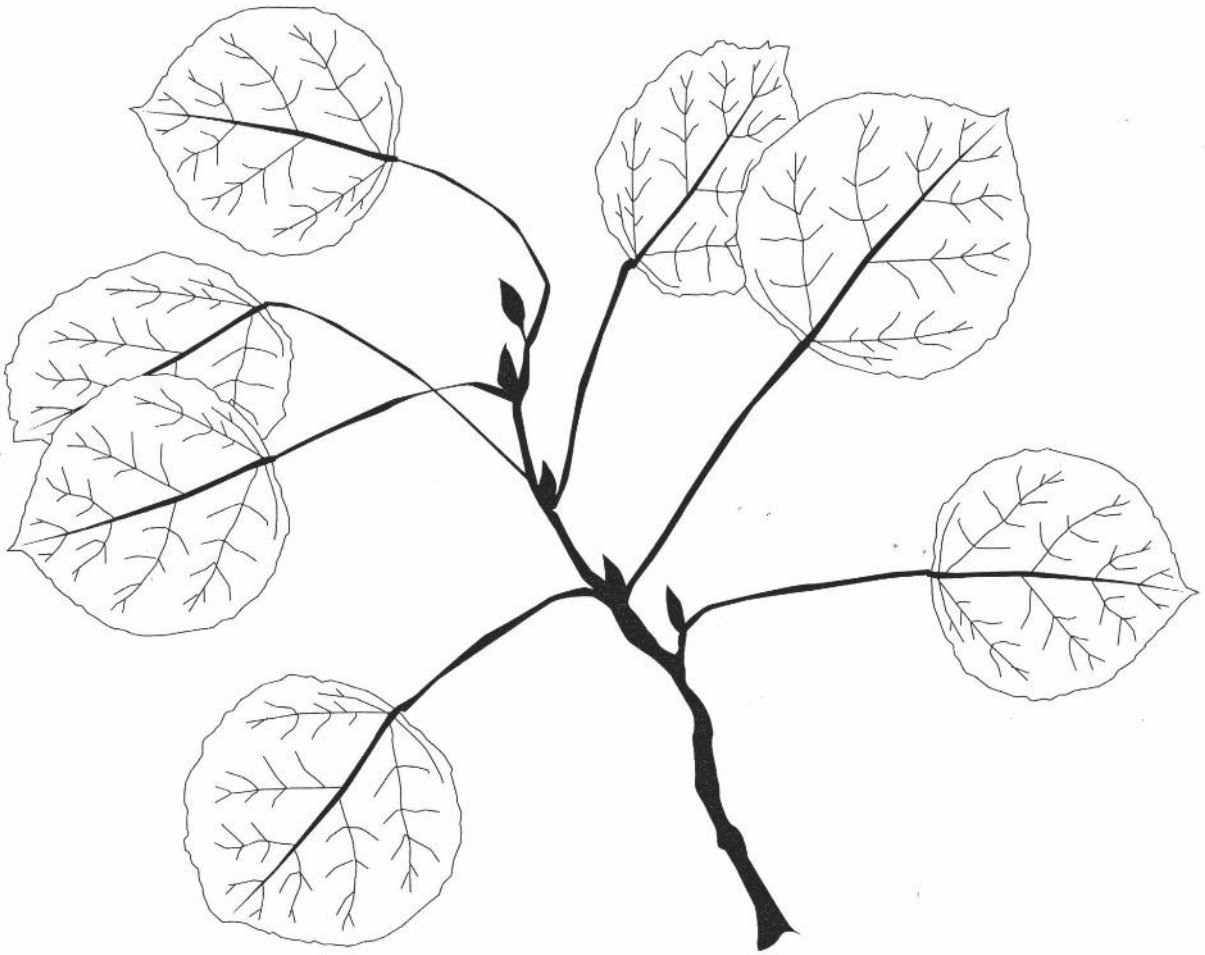
Red oak

Quercus rubra

Quaking aspen

Leaves: The quaking aspen has simple, alternate, finely serrated leaves.

It's called a "quaking" aspen because when the wind blows, the leaves look like they're trembling!



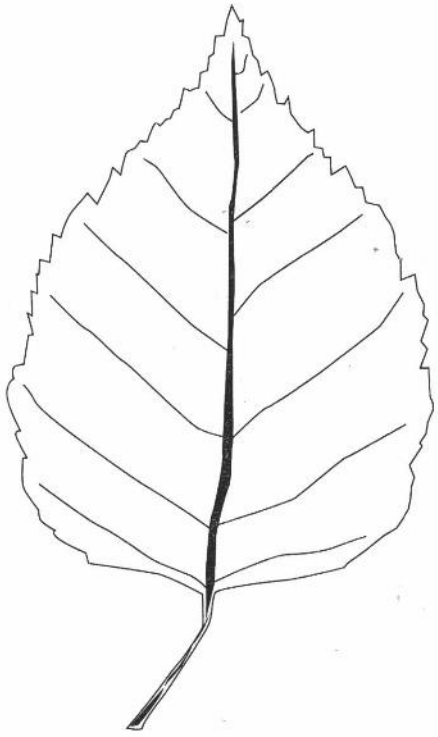
Quaking aspen
Populus tremuloides

White birch

Leaves: The white birch has simple, alternate leaves that are double-serrated around the edge.

The white birch is also known as the paper birch.

Be careful! The white birch's bark can be easily peeled from the trunk of the tree, but you must never, ever remove the bark from a living tree. A tree depends on its bark for protection and can die if it is removed.

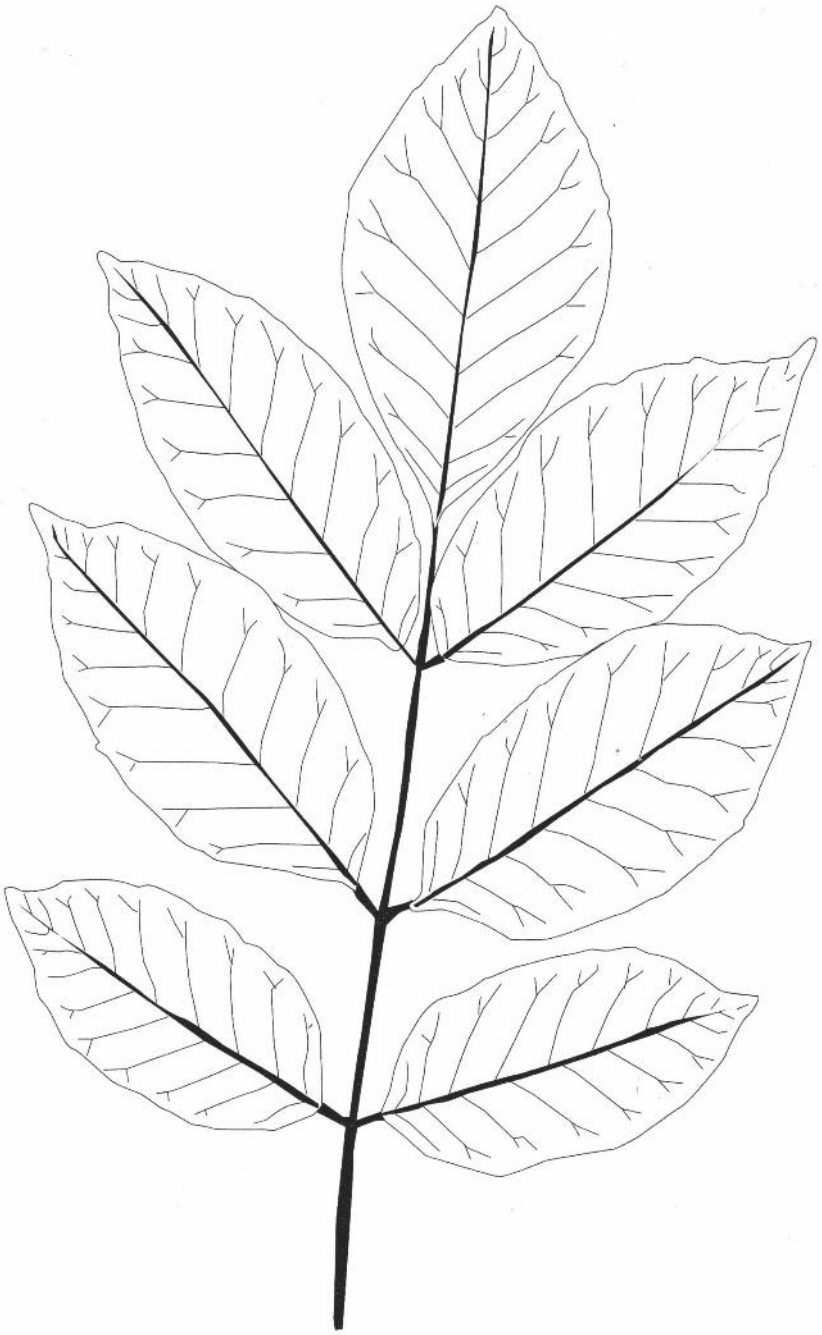


White birch

Betula papyrifera

White ash

Leaves: The white ash has compounds of five to nine opposed oval leaflets, which are sometimes slightly serrated.

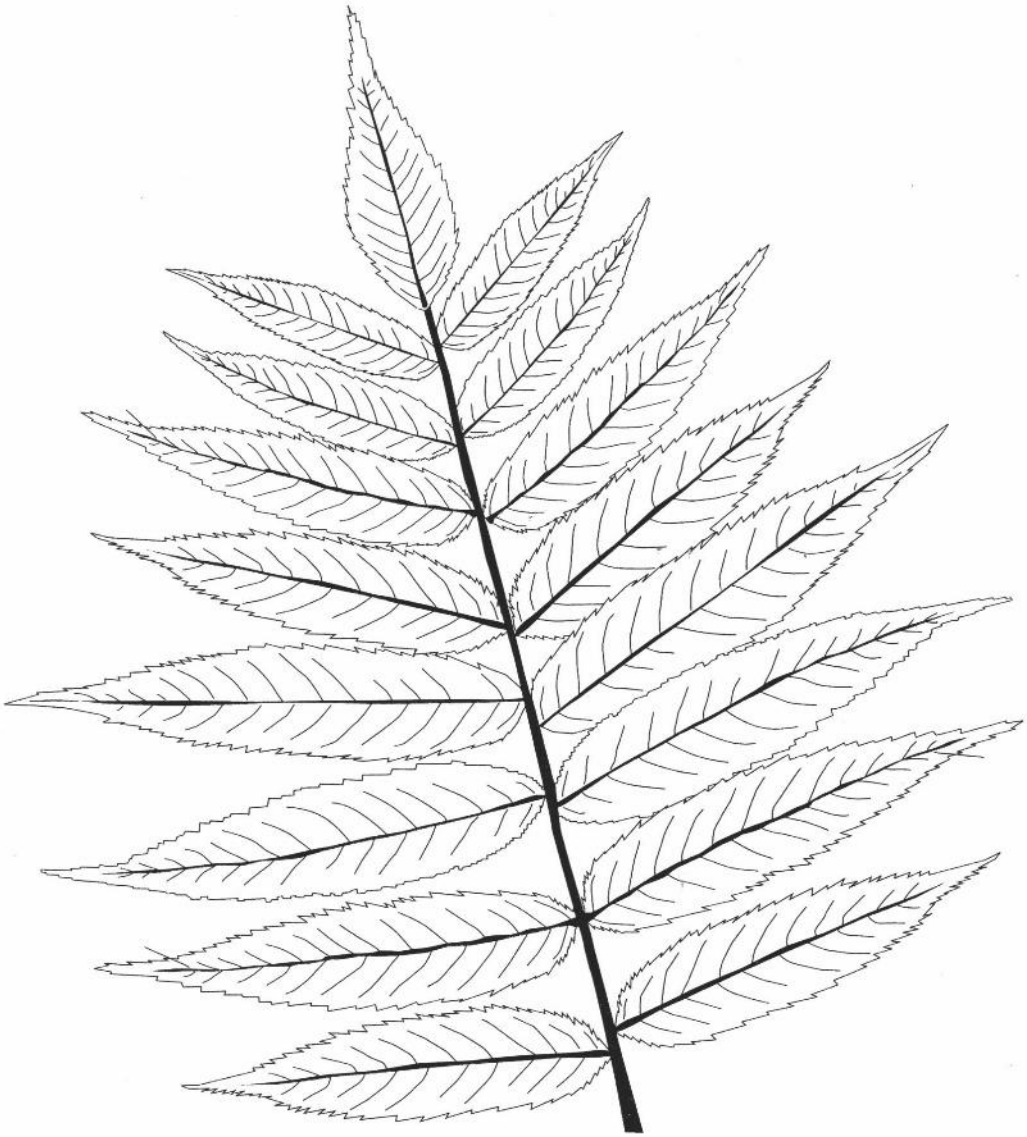


White ash
Fraxinus americana

Staghorn sumac

Leaves: The staghorn sumac has compounds of many alternate, serrated leaflets.

The red fruit of the staghorn sumac grows in very dense bunches. The dried fruit of this tree can be used to make herbal tea.



Staghorn sumac
Rhus typhina

THE OFFICIAL TREES OF CANADA

Canada	Maple
Northwest Territories	Tamarack
Yukon	Subalpine fir
Newfoundland and Labrador	Black spruce
Nova Scotia	Red spruce
Prince Edward Island	Red oak
New Brunswick	Balsam fir
Quebec	Yellow birch
Ontario	Eastern white pine
Manitoba	White spruce
Saskatchewan	White birch
Alberta	Lodgepole pine
British Columbia	Western red cedar
Nunavut	doesn't yet have an official tree (Because the ground in Nunavut is frozen year-round, the trees that do grow in Nunavut are very small. They don't grow much higher than your knee!)