Inquiry-based Ecological Explorations in the Bras d'Or Lake Biosphere

Introduction to the Acadian Forest: An Integrated, Multidisciplinary, Inter-Cultural Curriculum Resource for Elementary Classrooms

Bras d'Or Lake Biosphere Reserve Association
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Ecological Explorations in the Bras D'Or Lake Biosphere

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Section 1: Introduction to the Acadian Forest of the Bras d'Or Lake Biosphere

The Bras d'Or Lake Biosphere is nestled in the heart of Unama'ki, one of the seven traditional districts of the Mi'kmaw nation. This territory is covered by the "Treaties of Peace and Friendship" which Mi'kmaq and Wolastoqiyik (Maliseet) people first signed with the British Crown in 1726. The treaties did not deal with surrender of lands and resources but in fact recognized Mi'kmaq and Wolastoqiyik (Maliseet) title and established the rules for what was to be an ongoing relationship between nations. The indigenous Mi'kmaq have been joined by settlers from all over the world in this ancestral territory. Before European settlement, openings in the forest were mostly limited to wetlands, rock outcrops, areas damaged by pests, fire and windstorms along with small openings created by Mi'kmaq for temporary settlements. Large areas of the original forest were cleared by settlers and the resulting wounds on the landscape can still be seen. In the Bras d'Or Lake Biosphere there are many stands of forest in various stages of succession. This integrated, multidisciplinary, inter-cultural curriculum resource for elementary classrooms will inspire students to learn a bit more about the local Acadian forest through some simple exercises. Students will learn to recognize some common trees in the Bras d'Or Lake Biosphere using simple dichotomous keys, a valuable tool in all of the natural sciences. They will learn how to estimate tree height using simple geometry and they will become acquainted with the trees as Mi'kmaw medicines by measuring Vitamin C content of conifer tea, a common tonic enjoyed by early Mi'kmaq and the remedy for scurvy that saved Jacques Cartier's crew in 1535-1536 (Rousseau, J., 1953).

The change from an abandoned field or pasture to a shade-tolerant hardwood or mixed wood forest is referred to as plant succession (early succession to mid then late succession and finally

to the climax forest). In the Bras d'Or Lake Biosphere, stands of white spruce are a good indication that the area may have been farmed in the past (Drinkwater, M.H., 1957).The make-up of the Acadian forest varies from site to site depending on such factors as soil fertility, moisture and the availability of seed sources. Each stage of the succession process will have its own associated set of birds, insects, mammals and reptiles. The activities in this Learning Experience can be done anywhere, including areas that are close to the school yard. If you locate individual trees with a permanent marker, you can provide a starting point for future students. You can undertake all sections of this resource or choose only a subset. To accommodate that flexibility, the resource is divided into sections. Start with tree identification. You can bring a few branches into the classroom for 'practise'. You can then pick a nice day to be outside and have the students undertake some basic observations/ measurements on the trees that they have chosen and identified. This 'getting to know your tree' activity can be followed by reflection including some stories or Legends from Mi'kmaw culture that underlie the basic premise of MSIT No'kmaq (we are all related) and an examination of the trees as medicines by estimating the Vitamin C content of traditionally-prepared conifer teas.

Setting the Scene

It is always a good idea to start lessons with a brainstorming session. Ask how many students have taken a hike in the woods. How many students know how to recognize local trees such as sugar maple, red maple, yellow birch, hemlock, balsam fir, spruce, white pine? Have they ever tasted a yellow birch twig? Have they ever chewed spruce gum? Do they know of trees where eagles rest? Do they know if these trees have an economic value (do they have wooden furniture?)?

References for Section 1

Drinkwater, M.H., 1957. Field Spruce in Nova Scotia. Dept. of Northern Affairs and National Resources, FORESTRY BRANCH; Forest Research Division Technical Note No. 65 (http://www.cfs.nrcan.gc.ca/bookstore_pdfs/30544.pdf)

Rousseau, J., 1953 (Translated by J. L. Launay). Jacques Cartier et la Grosse Maladie, Ronald's Printing, 1953.

Section 2: Recognizing common trees in the Bras d'Or Lake Biosphere

Recognizing the different types of common trees is a useful skill to start with. We have included three simple guides. If the tree has needle-like leaves, use Tree Guide 1. If it has broad leaves shaped like a maple leaf, used Tree Guide 2. If it has broad leaves that are oval, elongated or triangular, use Tree Guide 3. These guides cover most of the common trees in the BLBR and are written for non-specialists. We have included pictures in the guides with an accompanying key to the pictures and several pages which feature one of the trees in greater detail. In parentheses are the Mi'kmaw tree names and the genus and species. Teachers should choose which of these supports are appropriate for their students. The tree guides are designed as 'dichotomous keys', a standard tool for biological identification.

Dichotomous keys for identification

A dichotomous key is a tool to help in the identification of plants and animals in nature. A stepwise procedure leads a user to a more accurate identification. Each decision point is divided in two which takes you down one path or another. "Dichotomous" means "divided into two." As an example, look at Tree Guide 1. This guide can be used to identify the most common local trees which have needles (also called conifers). The first decision is whether the needles are in a group on the twig or whether they are single. If the needles are joined to the twigs individually the student must then decide if the needles are round and sharp or if they are flat. They may have to sample needles from several different trees and compare their 'flatness' and 'sharpness'. Encourage the students to take needles and roll them around in their fingers. If the students determine that the needles are sharp they should then assess whether the twigs are hairy or smooth. A small hand lens may be useful here. Again, a comparison among several different trees may help the student determine what a 'hairy' twig looks like. Eventually the student will identify the hairy-twigged tree as a black spruce, one of the most common spruces in the region. The smooth-twigged spruce will probably be a white spruce. Added verification of that identification is the smell. The white spruce is also called 'cat spruce' which is reminiscent of the smell of the urine of a male cat. This smell makes the white spruce particularly unsuitable as a Christmas tree for the house.

Ecological Explorations in the Bras D'Or Lake Biosphere

This exploration of a simple dichotomous key will arm the student for a career in Forestry, Botany or many other branches of science as they are widely used for identification of many things!

Materials

1. Tree identification guides (either as a paper copy or a digital copy on a tablet)
    a. The quick guides may be adequate
    b. For more experienced teachers and/or students, take along a good tree identification book
2. Magnifying lens
3. Data collection sheet

Pre-planning

1. Teacher should have a list of trees for the area that is visited (use the tree guides that follow and do a test run).

2. Teacher should collect branches from one or two conifers, maples and birch trees for a pre-trip classroom examination. Supply the students with the three Tree Guides and try to identify samples as a group. Have the students modify their own Guides with notes that may help them later with their field identifications.

3. If the site is near the school, the teacher may wish to mark a few trees that can be visited in subsequent years either by new students or by the current students in later grades. Marking can be done by using a metal tag with an etched number that is permanently affixed (a nail in an area above the root, for example). The teacher can measure tree height to compare with the students' estimates. There are many ways to measure tree height. A simple technique has been outlined in section 3.

Procedure

1. Have the students prepare their tree ID guides (see above) and make sure that they take them along to the site

2. Have the students identify each tree and mark it with survey tape (and a permanent marker) or a more permanent sign

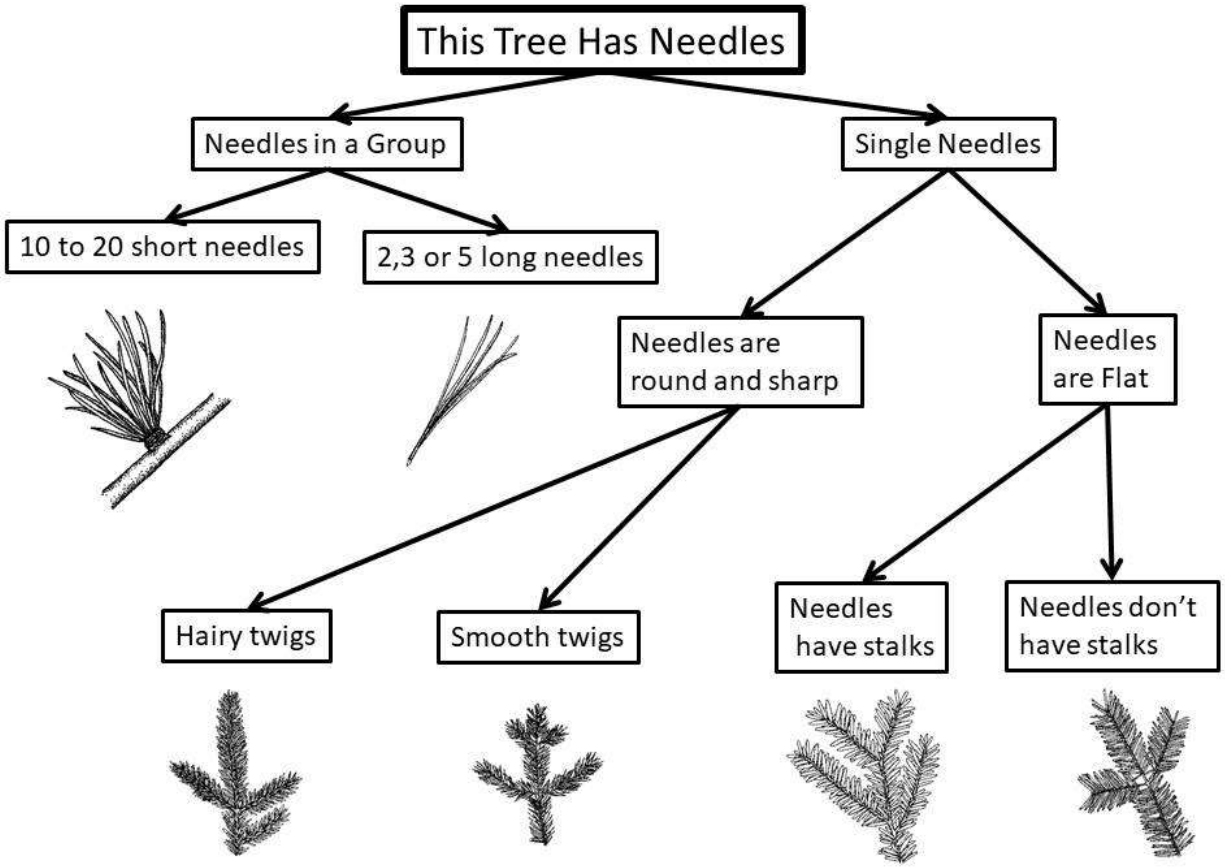
3. Create a master list of different trees the students have seen in and around the school yard. Offer a reward for unusual trees that you may not have seen in your test run. This will inspire the student to do a bit of research on their own to make sure that their identification is accurate.
4. Have the students choose one or more of their identified trees to do further research on. For example. they can find out what the distribution of that tree is using an Interneat search
5. Have the students fill in the first column of their data collection sheets.

Data Collection Sheet: Getting to Know the Trees

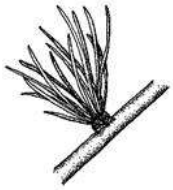
Name					
Date					
Location					
ID # (if tagged)					
Tree Height (comparative scale (ie: as tall as teacher, as tall as the school bus, as tall as the school building, 3 times my height as estimated by a comparison with my shadow))					
Tree Height if estimated (section 3)					
Tree Circumference (cm) at 1.5 m above ground surface					
Identity of tree (Tree Guides 1,2 and 3)					
Canopy observations (lots of leaves or few?, produces a lot of shade or not?)					
Is the tree healthy?					
Are there any animals (ie: insects, birds) using this tree as habitat?					

Tree Guide 1

Common Conifers
(Trees with Needles)



Common trees with needles



Tamarack (Hackmatack)

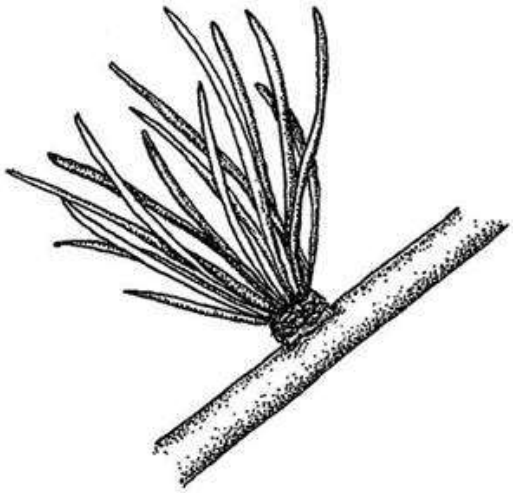
White Spruce (Kjikmuatkw)

White Pine (Kuow)

Hemlock (Ksu'sk)

Black Spruce (Kawatkw)

Balsam Fir (Stoqn)



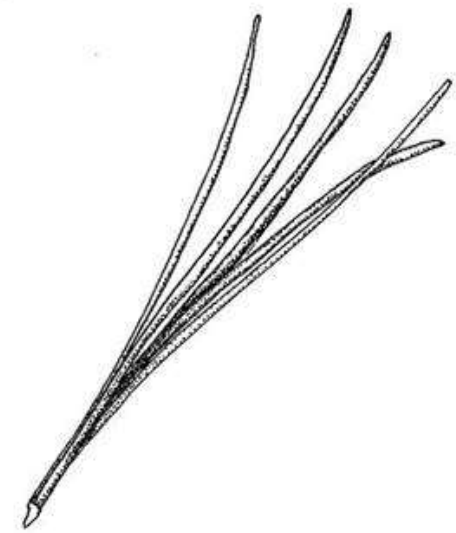
Tamarack (Hackmatack)

(Larix laricina)

This tree:

- has 10 to 20 short needles in a group
- loses its' needles in the winter
-lives in places where the soil is wet
- needs lots of sunlight so does not grow well in the shade
- is called *tamarack* which is derived from the Algonquin name (*akemantak)* and means "wood used for snowshoes" (https://www.for.gov.bc.ca/hfd/library/documents/treebook/tamarack.htm)

-has bark which is used as a medicine for colds and skin ailments by Mi'kmaq (Moerman, D., 1998)



White Pine (Kuow)

(Pinus strobus)

This tree:

- has 2, 3 or 5 long needles in a group
- was used as a tea by Mi'kmaq
  - tea was used as a medicine for colds, scurvy, skin sores and swelling (Moerman, D., 1998)

- has needles which have a high concentration of Vitamin C

Black Spruce (Kawatkw)
(Picea mariana)

This tree

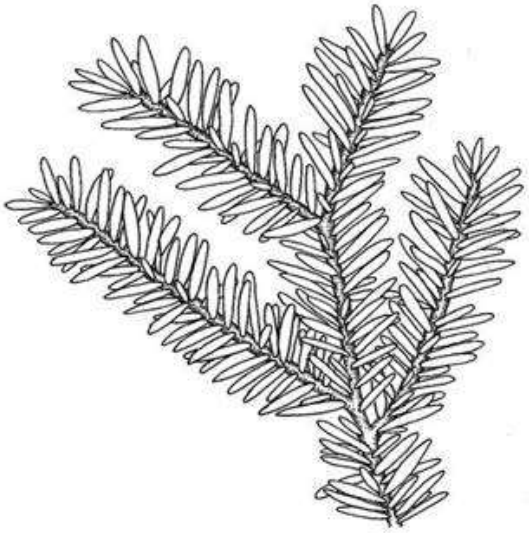
- has single needles which are round and sharp on a hairy twig
- is very common in Nova Scotia
- was used for tea by Mi'kmaq
- has soft boughs which were used for bedding by Mi'kmaq
- has long, skinny roots that were used to sew birch bark canoes by Mi'kmaq

(Moerman, D., 1998)

White Spruce (Kjikmuatkw)
(Picea glauca)

This tree

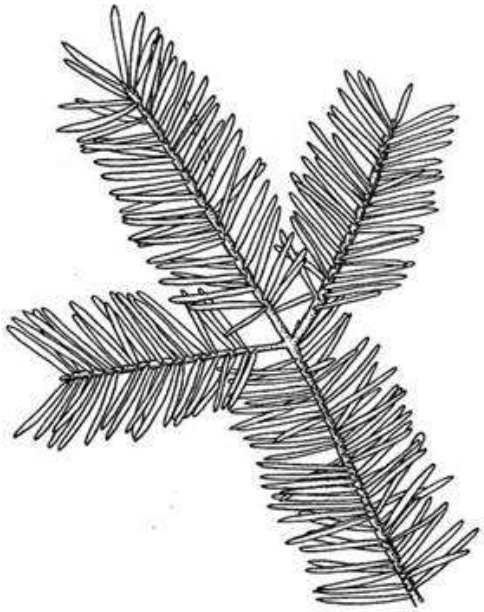
- has single needles which are round and sharp on a smooth twig
- has bark which was used by Mi'kmaq as a tea which
  - is high in Vitamin C
  - was used as a cold medicine (Moerman, D., 1998)
- has a gum which was used by Mi'kmaq as a bandage for wounds (Moerman, D., 1998)



Hemlock (Ksu'sk)
(Tsuga canadensis)

This tree

- has single, flat needles on stalks
- lives in areas that are cool and humid
- can live a long time and become very tall
- has needles and new twigs which were steeped into a tea
    - tea was used as a medicine for colds, scurvy and stomach troubles by early Mi'kmaq (Erichsen-Brown, C., 1979)



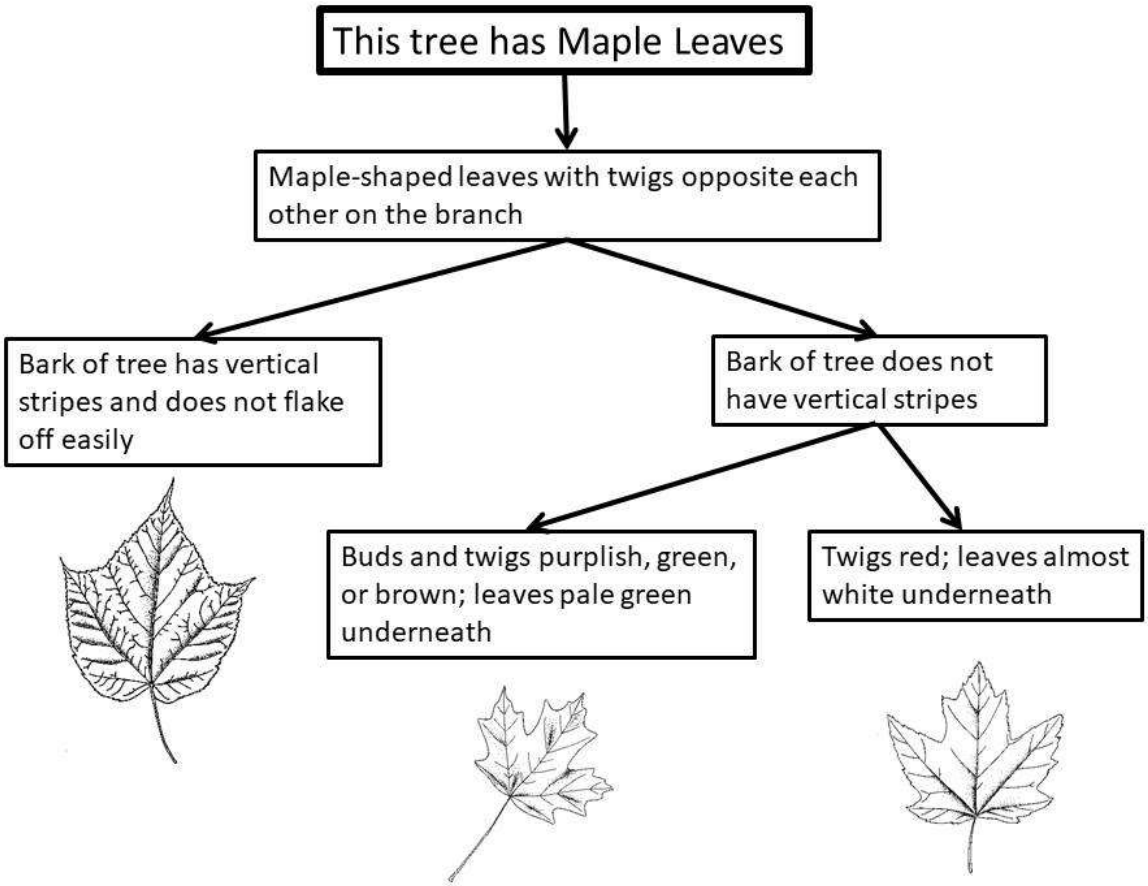
Balsam Fir (Stoqn)
(Abies balsamea)

This tree

- has single, flat needles with no stalks
- is often used as a Christmas tree
- Has new branches, cones, inner bark and needles which were often used by Mi'kmaq to brew a tea which
    - Is high in Vitamin C
    - was used as a medicine for diarrhea
- has gum that was used by Mi'kmaq to treat burns, colds, bruises, sores and wounds (Moerman, D., 1998)

Tree Guide 2

Common Maple Trees



Common Maple Trees

Moose maple; striped maple (malsnawej)

Sugar maple (snaweyey)

Red maple (kmu'jijapiey)

Moose maple (malsnawej)
(*Acer pensylvanicum*)

This tree:

- Is usually quite small
- Has large leaves
- Can tolerate shade
- Likes to grow on slopes or in moist environments
- Early Mi'kmaq used the bark to make a tea which was used for coughs and colds (Moerman, D., 1998)
- Is eaten by moose and other herbivores

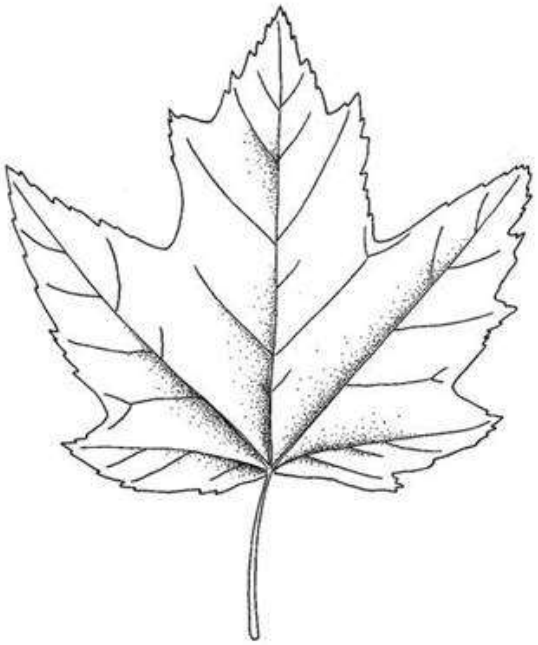
Sugar Maple (snaweyey)
(*Acer saccharum*)

This tree:

- Is a source of maple syrup
- Is Canada's national tree
- Has hard wood that is used for bowling alley floors, pool cues, guitar necks and many other items
- Produces sap that was boiled down by early Mi'kmaq to use as a seasoning for cooking (Moerman, D., 1998)
- Wood used to make bows and arrows by early Mi'kmaq (Moerman, D., 1998)

Red Maple (kmu'jijapiey)

(*Acer rubrum*)

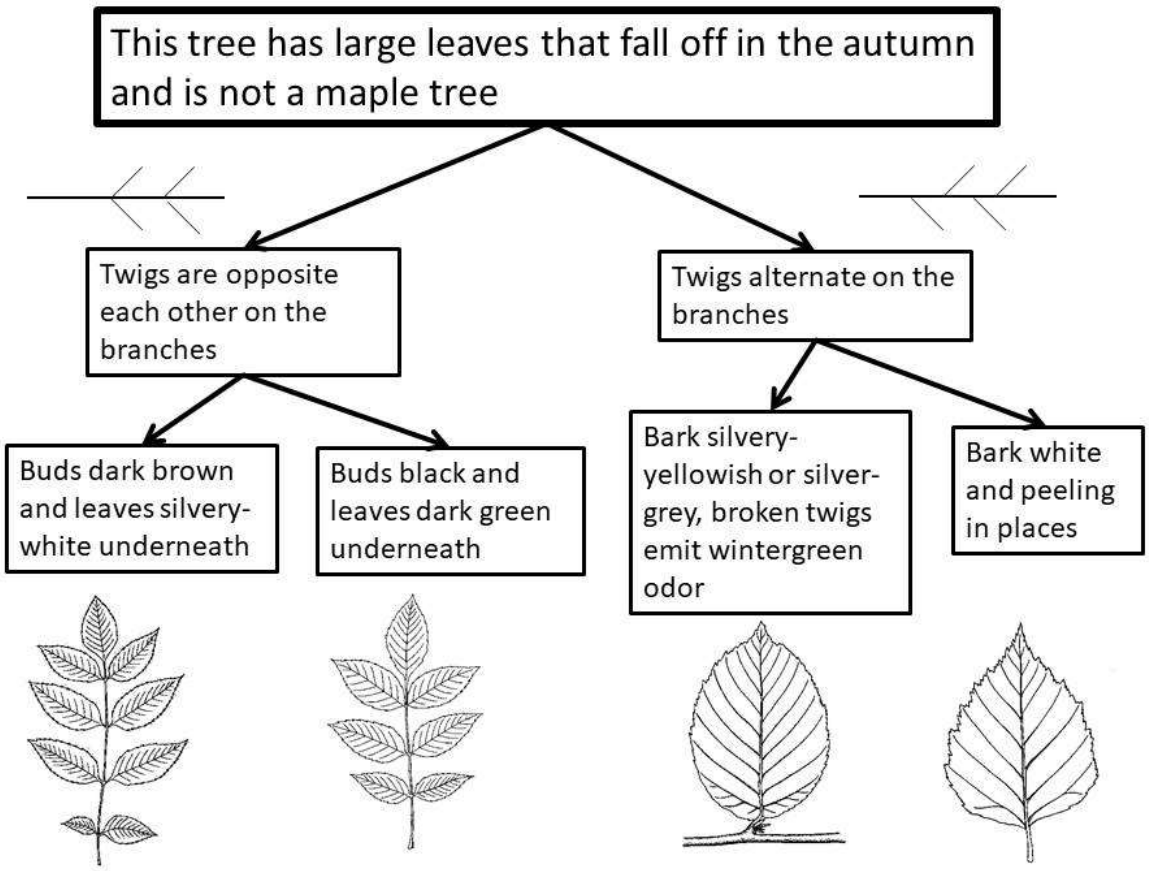


This tree:

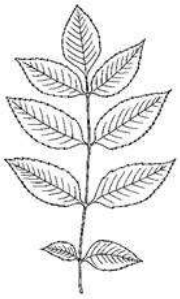
- Grows fairly large
- Is a common tree in the Acadian forests of Nova Scotia
- Has mature leaves that are 9 to 11 cm long
- Grows in a variety of habitats
- Has new growth which is a source of winter food for the white-tailed deer
- Has wood that was used by early Mi'kmaq for basketry (Moerman, D., 1998)

Tree Guide 3

Four Common Deciduous Trees that are not Maples

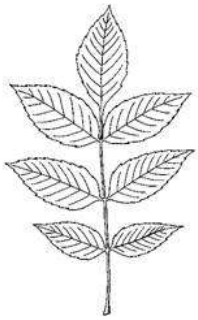


Common Trees (not maples) with large leaves that fall off in autumn

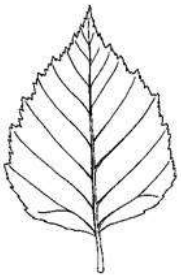


White ash (wisqoq)

Yellow birch (nipnoqan)



Black ash (wiskoqey)



Paper birch (Maskwi)

White Ash (wisqoq)

(Fraxinus americana)

This tree:

- is the most common ash tree in Canada
- has wood of great commercial importance
  - used to make baseball bats, hockey sticks and furniture
- was used by early Mi'kmaq (leaves for cleansing after childbirth and the wood to make tools) (Moerman. D., 1998)

Black ash (wiskoqey)

(Fraxinus nigra)

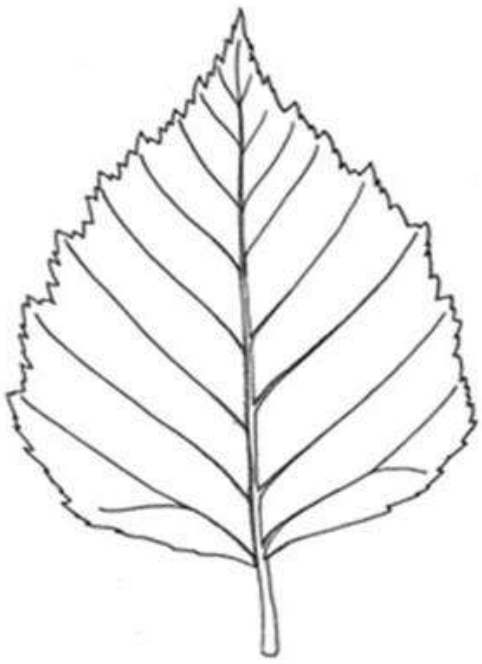
This tree:

- is commonly found growing in swampy areas, often with alder shrubs
- has wood with unique features that enable it to be pounded and peeled into thin strips
  - ideal for basketry, barrel hoops, snowshoe frames and canoe ribs
- is an Important material for Mi'kmaw basketry (Moerman, D., 1998)

Yellow birch (nipnoqan)
(Betula alleghaniensis)

This tree:

- has bark on mature trees which is a shiny yellowish-bronze which peels in thin horizontal strips
- has twigs that smell like wintergreen when broken
- is common in cooler conditions such as north facing slopes, stream banks
- has twigs which are browsed by moose and white-tailed deer



Paper birch (Maskwi)
(Betula papyrifera)

This tree:

- is the common white birch tree which is also called 'canoe birch'
- has young shoots that are browsed by moose and white-tailed deer
- is common in the Acadian forests of Nova Scotia
- Was used by early Mi'kmaq for wigwams, canoes, baskets, coffins, cooking utensils, trumpets for calling game (Moerman, D., 1998)

References for section 2

Erichsen-Brown, C., 1979. Medicinal and other use of North American Plants: A Historical survey with special reference to the Eastern Indian Tribes. Dover, New York, 512 pages.

Moerman, D.E., 1998. Native American Ethnobotany. Timber Press Inc., 927 pp.

Section 3: Measuring or Estimating Tree Height

Choose a tree that can be seen from a distance (ie: a stand-alone) from the assembled list of trees that have been identified. To estimate the height of a tree, basic trigonometry can be used either by a student or the teacher. We need an estimate (or measurement) of the distance that the observer is standing from the tree, the angle from 'level' that the observer's eyes forms when gazing upon the treetop, the height from the ground to the observer's eye and a table of trig values (in particular, the tan)(see accompanying diagram). This exercise is suitable for trees within an observer's line of sight. Refer to the accompanying diagram.

The tan of an angle is the ratio of the length of the opposite side to the length of the adjacent side.

Tan (Θ) = opposite length (y) / adjacent length (x)

To estimate components of the 'tree height estimation' triangle:

1. ***Adjacent distance***

Use a tape measure to get the distance from the observer to the tree. If you don't have a tape measure to measure that distance you could get a student to count the number of standard 'strides' used to get from the observer to the tree and then measure a standard stride (in meters) and multiply to estimate the total distance.

2. ***Angle***

As the observer gazes upward to the top of the tree, the line of sight forms an angle with the horizontal. You need to estimate the value of that angle. The horizontal can be 'fixed' using a standard hand-held level (a carpenter's level is fine). The angle of the gaze can be estimated either by holding up a protractor (an observer's helper would be useful here) or by using a cell phone app. That will give you a value for Θ. You can then get the tan of Θ from a table either on the web or in a book. For example, if the observer is craning his neck with an angle of 55^{o} above horizontal to see the top of the tree, the tan value would be 1.428 and that would be multiplied by the distance between the tree and the observer. That value would be added to the eye height and you would be left with an approximate tree height. It is that easy! This exercise may be an enrichment activity for elementary students who are strong in math or it may be a practical exercise for high school geometry students.

3. ***Eye height***

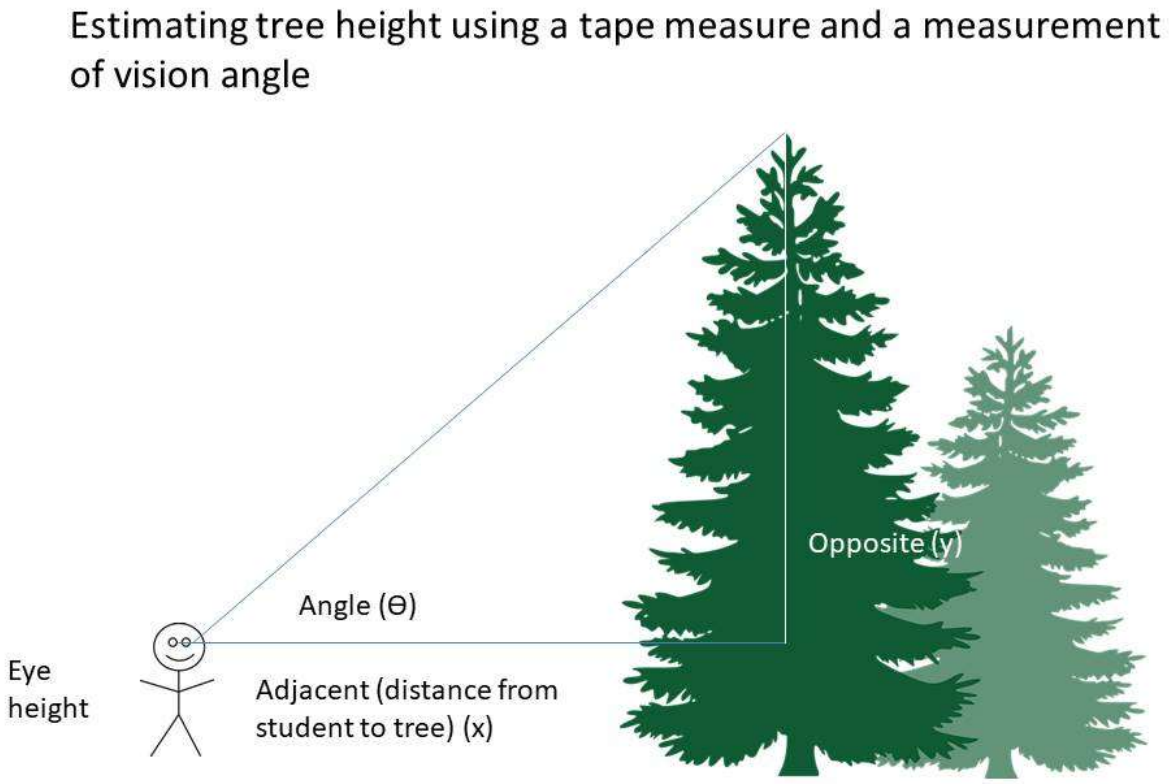
Since the observer's eye is not on the ground, a small correction for observer height is required. Add that to the calculated value of the adjacent side (ie: tree height).

Estimated tree height:

Tree height= adjacent* tan (angle of gaze of observer) + height from ground to observer's eye

Data Collection

Have the student record the estimated height of the tree in the data collection sheet.



Going a bit further

Have the students brainstorm other ways to estimate tree height without actually measuring it. One enterprising young student may decide to stand beside a tree on a sunny day and measure her shadow and the tree's shadow. By calculating a correction factor relating his actual height to the shadow's height and applying it to the tree's shadow, she may have a decent estimate of tree height.

References for section 3

https://www.youtube.com/watch?v=hrwL3u2Z4Kg

http://bigtrees.forestry.ubc.ca/measuring-trees/height-measurements/

Section 4: Really Getting to Know Your Trees

Students can become familiar with some of the measurements that foresters use when characterizing trees. The first step is to identify the tree. The student can then estimate its' height and measure its' diameter at chest height (called DBH (diameter breast high)). They can then fill in a table and start to compare the measurements among trees. Do taller trees always have a larger chest-high diameter? Do conifers always have a smaller diameter at chest height than deciduous trees of the same height? Not only are the students collecting scientific data; they are becoming better acquainted with the trees.

After this trip to a forest site, gather the class and put their data together to assemble a master data sheet. How many different tree species did you find? Were they all small? All large? A mixed group of sizes?

Have them brainstorm some ideas that will help future classes with the same exercise. Was it difficult to distinguish between varieties? Was your ID guide in need of modification? How? Did you learn anything specific about any certain trees to help you identify it in the future without a tree identification guide? Were some trees associated with certain other trees (growing together or separately)? Were there animals associated with certain trees?

What effect do they think that a shift to a forest that is all white spruce (because of clearing) going to have on other plants and animals?

Section 5: MSꟻT No'kmaq

MSꟻT No'kmaq is a Mi'kmaw phrase meaning 'all my relations' which underlies the understanding that all parts of the ecosystem are interdependent. Trees are not just obstacles that you have to go around when you are walking or producers of leaf litter that Dad has to clean out of the house gutters. Early Mi'kmaq lived in the Bras d'Or Lake Biosphere when the forests looked quite different. They used trees sustainably for many things including shelter and medicines. In this sense a medicine has a much broader meaning than a pill that you get from a pharmacist. A medicine is something that contributes to your well-being. In this case, conifer teas are tonics or medicines.

Background

Mi'kmaq helped the French avoid scurvy by drinking tea made from local conifers (Hatcher, A. and Bartlett, C., 2009). The following exercise for elementary students is related to measuring the Vitamin C content of conifer teas.

In Mi'kmaw culture teas made from various plants are considered as medicines because they contribute to good health. Teas made from various conifers are very high in vitamin C and served as a significant source of this nutrient in winter. It was tea made from eastern white cedar by Mi'kmaq people that cured Jacques Cartier's crew of scurvy in the winter of 1535–1536 (Rousseau, J., 1953). However, conifer needles contain other compounds that are toxic if consumed in large quantities so it is very important to limit consumption of medicinal teas to doses that are appropriate to body size. To determine a dose proportional to body size, a branch of the tree was held between the elbow and an outstretched finger (Meader,J., personal communication).

The measurement of Vitamin C concentration in various fruit juices has been a popular science fair project for elementary students for a long time. Students are generally not pleased by the taste of a conifer tea (sweetened with maple syrup) but are quite surprised at the results.

Measuring vitamin C in conifer teas

(from: Hatcher, A. & Bartlett, C., 2009)

"*Not many students think of food when shown a coniferous tree. In itself, this is an eye-opener that encourages students to look at their environment in a different way. The following exercise has students compare the nutritional value (vitamin C concentration) of traditional and modern foods containing vitamin C. Topics that can be discussed in conjunction with this exercise include:*

1) *What is vitamin C?*

2) *Why do our bodies need it?*
3) *What happens if we do not have enough?*
4) *How do modern people obtain vitamin C in the winter?*
5) *How much vitamin C is in tamarack tea, spruce tea or balsam fir tea compared to a modern source, such as orange juice?*

Preparing tea

Prepare teas from several local coniferous species. Needles from various species of conifer, such as tamarack (Larix laricina), red spruce (Picea rubens) and balsam fir (Abies balsamea), were made into teas by Aboriginal people in eastern North America. Teachers and students in other regions should seek out local traditional ecological knowledge to determine which of the coniferous trees in their area may be useful for this exercise. The amount of the tree used should be a length of a healthy branch equivalent to the distance from elbow to the tip of an outstretched third finger. Break up the measured length of branch and put the needles and small branchlets in a pot of water heated to a rolling boil (the volume of plant material and water should be roughly equivalent). Remove the pot from the heat and steep for approximately five minutes. Strain the liquid through folded cheesecloth into a cup, and sweeten to taste with maple syrup. The amount of vitamin C in each tea can now be compared to the amount contained in standard fruit juices, fruit drinks and commercial herbal teas.

Comparing vitamin C concentration

This is a simple comparison of concentrations of vitamin C, based on differences in the intensity of colour resulting from the chemical reaction between ascorbic acid (vitamin C) and iodine. Iodine will turn a solution of cornstarch and water a purple-blue colour, but it reacts with ascorbic acid to produce a colourless product called dehydroascorbic acid. In this test, equal volumes of a purple-blue indicator solution made of starch and iodine are added to equal volumes of the test liquids. If the sample has very little vitamin C, the solution will remain a deep purple-blue; if the sample has a higher concentration of vitamin C, it will become lighter as the

purple-blue iodine becomes colourless in reaction with the ascorbic acid. The more vitamin C in the test liquid, the lighter the solution. With this method, you can compare relative vitamin C content and rank foods from highest to lowest.

Materials:

1. *Cornstarch*
2. *2% iodine solution (available from pharmacies)*
3. *Eyedropper*
4. *Water*
5. *hot plate*
6. *heat-proof beaker or small pan*
7. *15-ml test tubes (one per sample)*
8. *samples of a variety of conifer teas and fruit juices*

Procedure:

1. *Make a starch solution by mixing 1 tablespoon of cornstarch into enough water to make a paste. Add 250 ml of water and boil for 5 minutes.*
2. *Using the eyedropper, add 10 drops of the starch solution to 75 ml of water to make a more dilute starch solution.*
3. *Add enough iodine to the starch solution to produce an indicator solution with a dark purple-blue colour. (approximately 1 ml)*
4. *Put 5 ml (1 teaspoon) of indicator solution into each of several 15 ml test tubes or vials, one tube for each liquid to be tested*
5. *To each tube or vial, add 10 drops of test liquid (juice or tea), using a clean eyedropper. Between samples, rinse the eyedropper with water.*
6. *To judge the intensity of colour, hold the test tubes against a white background. Line up the tubes from lightest to darkest purple. Vitamin C causes the purple indicator solution to lose its colour. Therefore, the samples with the highest concentration of ascorbic acid (vitamin C) will be the lightest colour of purple.*

Titration method:

For higher grades, a more complex experiment can be performed which includes standardizing the titration and calculating amounts of vitamin C. In the titration method, a cornstarch solution is added to equal volumes of the liquids to be tested, and then iodine is added dropwise to each solution. As the iodine reacts with ascorbic acid (vitamin C) in the solution, the colour remains the same. When all the ascorbic acid is neutralized, the iodine reacts with the starch in the solution and the colour changes. The amount of iodine added is directly related to the amount of vitamin C in solution."

References for section 5

(http://education.seattlepi.com/science-projects-vitamin-c-oranges-6184.html).

Hatcher, A., Bartlett, C., 2009. Traditional medicines- how much is enough? (Green Teacher Issue 86 (Fall, 2009), pages 11-13

Rousseau, J., 1953 (Translated by J. L. Launay). Jacques Cartier et la Grosse Maladie, Ronald's Printing, 1953.

Section 6: Stories, Legends and Reflections

Background

Stories, myths and legends play a unique, powerful role in Mi'kmaq culture. Many stories operate on several levels at once and the messages may be lost if the listener is unfamiliar with the culture. Also, many components make no sense when translated from Mi'kmaq to English or French (Holmes-Whitehead, 2006). Teachers are strongly encouraged to invite a Mi'kmaw Elder or knowledge holder into the classroom to share their understandings about trees.

The forest is very important in Mi'kmaw culture. The heart of Legends often is in the forest (Holmes-Whitehead, 2006):

"The image of the tree is one of great importance, an image 'essential to the beliefs and ritual practices of shamanism because it connects the three fundamental zones of the shamanic cosmos; its' roots penetrate the underworld, its' branches rise to the sky'".

Each lesson should start with a story. In Mi'kmaw culture storytelling is an interactive process and the essence of the story would change with each new audience. Have the students tell one of their own stories.

Recommended Resources:

To learn more about Mi'kmaw storytelling, consult:

Holmes-Whitehead, R., 2006. Stories from the six worlds: Micmac Legends. Nimbus Publishing, Halifax, 242 pages

There are many resources available on the web and in libraries which highlight the importance of trees and the forest and our relationship with them. The following are focused on local forests:

General:

Simpson, J., 2014. Journeys Through Eastern Old-Growth Forests: A narrative guide, Nimbus Publishing, Halifax, N.S.

Simpson, J., 2015. Restoring the Acadian Forest. Nimbus Publishing, Hfx, N.S.

Donly, James F., 1960. Identification of Woody Plants in Winter. Department of Lands and Forests, Bulletin No. 19.

Saunders, Gary L., 1970. Trees of Nova Scotia – A Guide to the Native and Exotic Species. Department of Lands and Forests, Bulletin No. 37.

Gibson, Merritt and Bondrup-Nielsen, Soren, 2008. Winter Nature. Gaspereau Press.

The following websites are useful:

www.macphailwoods.org

www.ontariotrees.com

www.northernontarioflora.ca

www.rook.org

www.borealforest.org

www.acapcb.ns.ca/baille_ard_trail

http://maple.dnr.cornell.edu/kids/index.htm

Maples:

(a book for the students to read):

Bernard, M.L., 2013. Sismoqnapui'skwe'j: Sweet Water Maiden [Micmac and English], Indian Maiden Maple Products (ISBN 0991742001, 9780991742004)

White Ash

http://www.historymuseum.ca/cmc/exhibitions/aborig/fp/fpz2f21e.shtml

Black Ash

http://www.uinr.ca/wp-content/uploads/2016/09/Wisqoq-Black-Ash-Fact-Sheet.pdf

Unama'ki forests as habitat

(for the students to read)

http://www.uinr.ca/wp-content/uploads/2015/05/NIPUKT-WEB-1.pdf

Mi'kmaw legend "The First Cedar Tree"

(for the teacher to read to the class)

Robertson, M., 2006. Red Earth: Tales of the Mi'kmaq. Nimbus Publishing, Halifax, pages 56-57.

Ecological Explorations in the Bras D'Or Lake Biosphere

Integrating into class-time

There are several ways that you can reinforce the ideas developed during this exploration. Repeat the exercise in different seasons, spring when buds are emerging, summer (leaves fully emerged), fall (colour changes in leaves), winter (identification through twig architecture and bud properties).

At the end of this investigation, students will be able to:

1. Recognize several of the most common trees in the Acadian forest of the Bras d'Or Lake Biosphere (and elsewhere) and learn their Mi'kmaw names.
2. Compare and contrast the characteristics of some common trees such as the architecture of the needles, the relationship between tree height and diameter of the trunk.
3. Understand the basic principles behind the use of the dichotomous key for identification of plants and animals.
4. Appreciate the Mi'kmaw concept that we are all related (MSꟾT No'kmaq) by understanding that trees benefit us in many ways including providing Vitamin C in winter and by understanding that trees are habitat for other forest-dwellers.