



LESSON SUMMARY

Students will develop the observation and classification skills necessary to identify trees by developing tree identification keys.



Activity Information

Grade Level: Intermediate

Estimated Duration: 1 to 1 ½ hours

Materials: At least 5 different leaves (coniferous and deciduous) per pair of students
6-8 conifer branches per pair of students
tree identification guides
notebooks and pencils
masking tape
markers
copies of Tree Wheels (one per group, optional)
at least 2 sheets of laminating plastic per student (optional)
1 sheet of drawing paper or newsprint and charcoal crayon per student (optional)

Setting: Indoor (classroom) and outdoor (access to trees for leaf collection)

Key Vocabulary: coniferous, deciduous, evergreen, leaf margin, leaf arrangement, dichotomous keys, broad leaf

Learning Goals:

1. Observe and identify differences between species of trees using their leaves
2. Learn how to develop a dichotomous key by communicating differences between different objects
3. Understand classification systems and the use of discrete categories to distinguish objects from one another



Background Information

At first glance, you can tell the difference between a maple tree and a pine tree; one has broad, deciduous leaves that fall off every autumn, and the other has long, evergreen needles and pine cones. This difference between deciduous (typically broad leaves that grow and fall within the same year) and coniferous (evergreen needle or scale-like leaves) trees is a simple classification system, and often the first step in tree identification!

Trees can be identified by the features of their parts (e.g., leaves, bark, twigs, buds, flowers, and fruits) and by their shape or silhouette. For some species, a particular feature stands out (e.g., white birch has a distinctive bark, white pine has a distinct windswept shape). However, leaves are the most common feature considered when identifying a tree, as they can be quite unique from tree to tree, and are broadly accessible.

There are a few factors taken into consideration when identifying a leaf. Below are some classifications used to distinguish deciduous or broad leaves.

- a) Shape.** Leaf blades can be long and narrow, oval, heart-shaped, spear-shaped or circular. Poplar leaves, for example, are generally oval in shape. Birch leaves are more triangular; basswood trees have heart-shaped leaves. Willow leaves are long and slender.
- b) Leaf margin.** Leaf edges, or margins, also differ. They can be smooth, finely notched, coarsely notched, or wavy. Maple and oak leaves are lobed. Ash, beech and elm leaves have toothed or rough edges.
- c) Leaf type.** Leaves can be simple (all one piece) or compound (divided into many separate leaflets). Beech maple, oak, and poplar have simple one-piece leaves. Hickory and ash have compound leaves composed of leaflets.
- d) Arrangement.** On some trees (e.g., oak, cherry), the leaves are attached alternately on the twig, which means that they alternate from one side of the twig to the other. On other trees (e.g., maples), the leaves are attached opposite each other, with two leaves side by side on the twig. Other trees have leaves arranged in a whorl (spiral arrangement around the twig), though that is more common on shrubs and herbaceous plants.

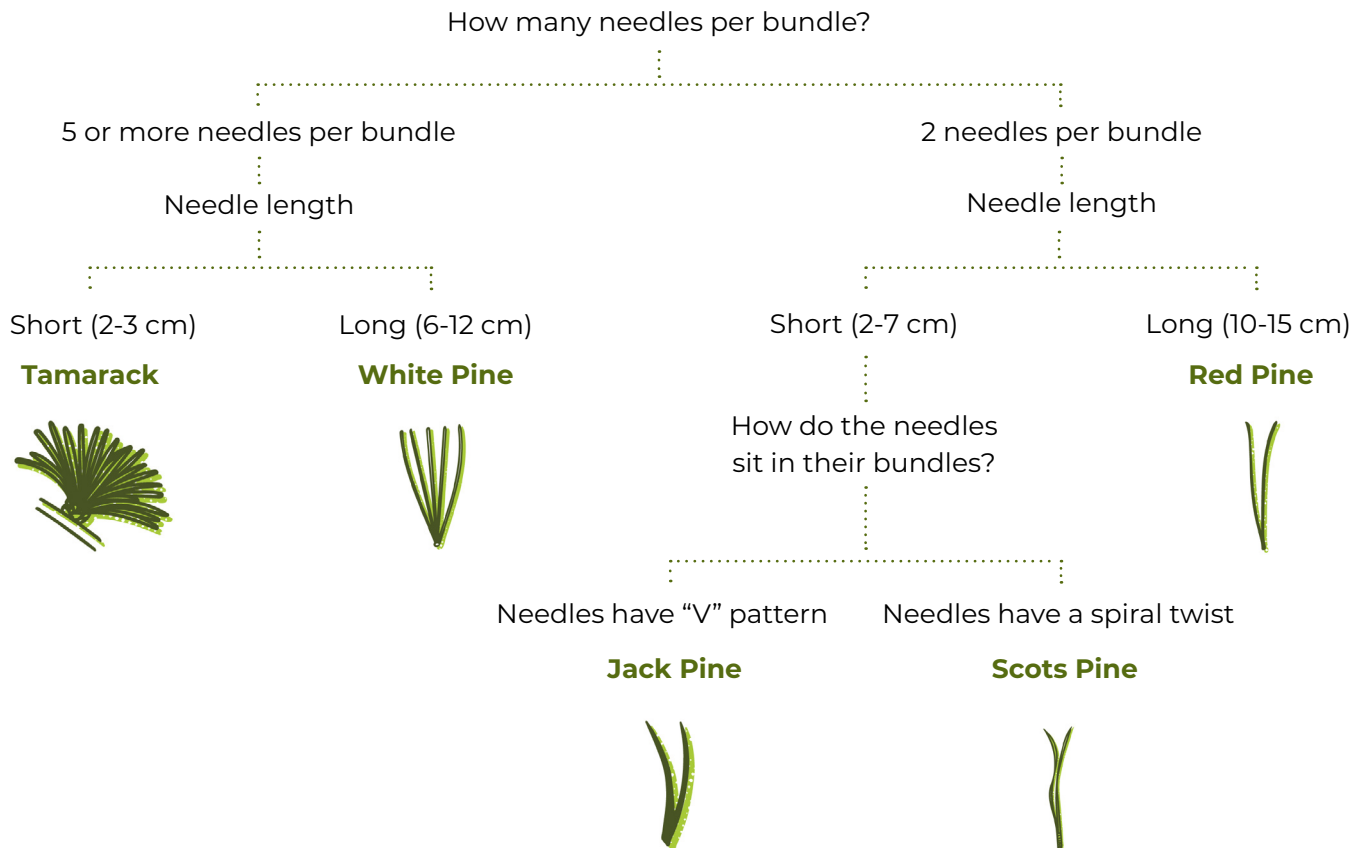
Evergreen leaves can also be differentiated by shape. For example, the leaves of the white pine are long and needle-like, while cedar leaves are flat and scale-like.

Some needle-like leaves occur singly on the twig; others occur in bunches. Spruce, hemlock, and fir needles occur singly. Pine needles are all in bundles; white pines have needles in bundles of five, whereas jack pine, red pine, and Scots pine have two needles per bundle.

These differences between leaves can be used to classify or identify trees from one another. They are commonly used in dichotomous or classification keys. These keys are used to differentiate tree species by asking a series of comparative questions or statements. Each question or statement has a discreet answer for each tree – that is, there is no overlap between the two (or more) potential options for any given question. Another way to think of a key is as a “choose your own adventure” path, or a series of offshoots in the road that move from clue to clue until an accurate identification is established. The following is an example of a classification key used to identify several species of pine.



Key to Selected Pines



Preparation

- Review the activities and determine which you will use. From that, collect the appropriate number of deciduous leaves or conifer branches for your class (if students are not collecting their own materials) for activities 2 and 5. Non-destructive collection methods (already fallen leaves, branches, etc.) are always preferred!
 - NOTE: trees planted in your schoolyard may not be native plants/may be ornamental species. They will not be included on a native tree key but can still be used when making your own keys!
- If not using physical leaves and branches, source images of different leaves and trees to print and hand out. Resources that may be useful for finding images of correctly identified trees include:
 - Tree Bee - <https://treebee.ca/>
 - iNaturalist - <https://inaturalist.ca/>
- For Activity 5, print out tree wheels (<https://forestscanada.ca/en/resource/tree-wheel>) for students to use while identifying conifers – it is a separate craft that results in a useable dichotomous key that can identify most conifers native to Ontario. Each wheel will need a brass split pin/fastener so that the two circles of paper are attached in the middle and can freely spin.



Activities

Activity 1

Step 1: Before going outdoors, ask your students: How many different kinds of trees are there on the school grounds? How do they know that these trees are different from one another? Have each student write down a rough estimate of the number of different types of trees on the school property. They do not need to know the tree names.

Step 2: Move outdoors and have your students compare their estimates with the actual number of trees on the grounds. Do they come close to their rough estimates? Have them observe the trees and devise new categories for their sorting system (e.g., divide trees into categories based on leaf shape).

- a. Encourage them to use their own systems for sorting or classifying the differences between trees (e.g., flowering trees/non-flowering trees; deciduous/evergreen trees). Assist your students in sorting their answers into categories.
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Step 3: Analyze the students' sorting systems. Do some trees fall into more than one category? Are the categories exclusive or overlapping?

Step 4: While outdoors, students may collect the leaves (from both evergreen and deciduous trees) in preparation for Activity 2 (encourage them to collect fallen leaves if possible), if you have not done so already.

**Activity 2**

Step 1: Discuss how botanists, foresters, environmental scientists, gardeners, or anyone who wants to know the name of a tree can use certain characteristics of the tree to lead them to correctly identify the tree. Introduce students to the characteristics of leaves that are used to determine a correct identification of a tree species (see Background Information).

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Step 2: Have students sketch each of the five different leaves collected. Make sure each sketch is at least half an 8 ½ x 1 inch page in size and that all distinguishing characteristics are shown.

- Alternatively, have students laminate leaves between sheets of adhesive plastic or do a leaf rubbing by placing the leaf under a sheet of paper and rubbing the surface of the paper with a charcoal crayon or the edge of a pencil lead.
- Label the distinguishing leaf characteristics on the sketches.

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Activity 3

Divide your class into groups. Call out one of the following features (or create your own categories according to the leaves found in your area). Using the sketches made in Activity 2, have students make piles of leaves that match these characteristics:

- all needles
- all broad leaves
- all lobed leaves
- all smooth leaves
- all toothed leaves
- all simple leaves
- all compound leaves

As students become more familiar with leaf characteristics, increase the complexity:

- all double compound
- all palmately lobed leaves
- all double-toothed
- all pinnately lobed leaves

Try:

- all pine needles
- all maple leaves
- all green leaves

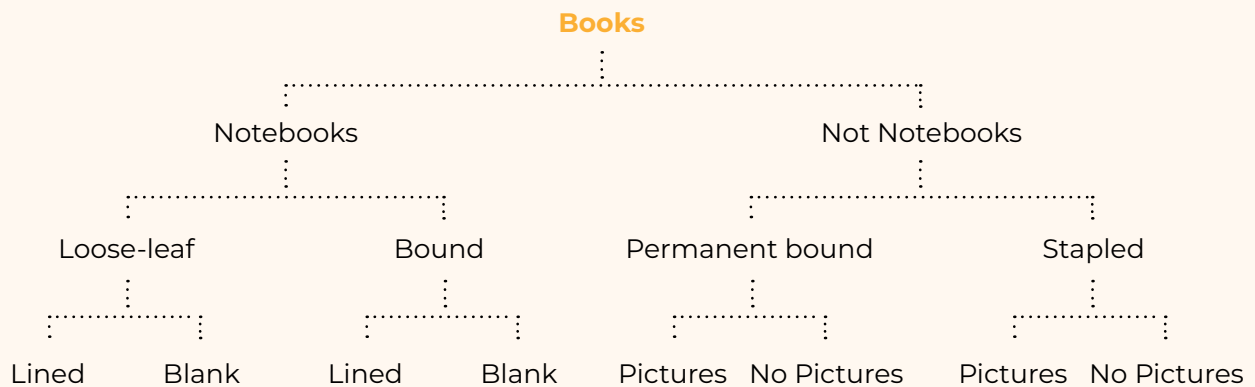


Activity 4

A dichotomous key is an identification tool that presents a series of two (hence dichotomous) questions or choices that are opposite traits. Among other things, dichotomous keys are often used to identify tree species. This activity has students construct their own keying systems that someone else can follow.

Step 1: Break students into groups. Choose objects that have several features in common (e.g., books — rectangular and made of paper; pens, pencils, and chalk — all roughly cylindrical and used for writing; paper clips and staples — made of metal and used to fasten paper) and then make a list of opposite characteristics that could be used to identify them. Use the example attached as a guide.

- a. It is easiest if the entire class can use the same materials for their keys, but you may want different groups to key out different things.



Step 2: Have students test out their keys by swapping them with another team. To test the key, students should choose objects from the category at random and key them out/determine if they can successfully identify what object they have selected using the key.

- a. Ask students: Do all of the objects fit into one of the categories? If not, there may be a problem with the key. Make sure that only opposite traits are listed, with no overlap between the categories.

Once the students have completed this exercise, they can then go on and create keys for trees.

**Activity 5**

With their new dichotomous key crafting skills, have students create keys for trees. These may include terminology that they are unfamiliar with, and they may need to reference the diagrams attached to this lesson plan.

Step 1: Divide students into pairs or small groups.

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Step 2: Give each pair six to eight conifer branches. If you do not have conifer branches, have students use the sketches or rubbings that they made in previous activities.

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Step 3: Give them the following instructions:

- a. Put masking tape on or around each specimen to form a label. Label each branch with a symbol (e.g., A, 1). (You don't need to know the name of the tree.)
- b. Choose one distinguishing characteristic that will divide the specimens into two exclusive groups (e.g., needles in bunches/ not in bunches). Separate the specimens into two groups according to this characteristic.
- c. Pick two more opposite characteristics (one pair for each group of branches) and separate the branches into four sub-groups based on these characteristics. Continue to do this until you have only one branch in each group.
- d. Draw a diagram of the whole key, right down to the individual branches. Use the symbols throughout the key.
- e. Trade keys and specimens with another group (remove masking tape labels first). If others are unable to correctly identify the branches, track down and correct the errors in the key.

If you are using conifer branches or needles, you can provide students with the Tree Wheel (<https://forestscanada.ca/en/resource/tree-wheel>) so that they can utilize a dichotomous key to identify the trees they are looking at.



Leaf Types



Compound

Simple



Scale-like

Needle-like
(single)

Needle-like
(bundles of 2)

Needle-like
(bundles of 5)

Arrangement on Twig



Alternate



Opposite



Leaf Types



Smooth



Toothed ("rough")



Lobed

Leaf Shapes



Linear



Triangular
(Deltoid)



Heart-shaped
(Cordate)



Oval
(Ovate)



Reverse oval
(Obovate)



Palmately
lobed



Pinnately
lobed