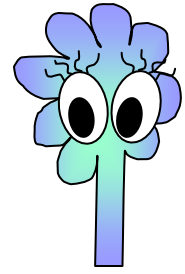


Trees and Forests



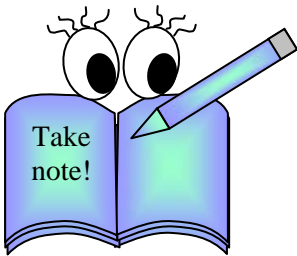
Why Trees?

We study the science of trees and forests as a way to learn scientific skills involved in classifying tree species, making observations, making inferences about observations, extending on chemistry, learning about life cycles (both animal and vegetative), learn basics of forestry management, and to appreciate the importance of trees in our world. Through this unit we will touch on each of these topics and extend upon them. You may want to use the side margins in this unit in order to summarize what is on the page.

T-1 What Makes a Tree a Tree?

It seems like a silly question, but there are some general characteristics that make a plant a tree. First off, trees are plants, all plants produce their own food by converting sunlight energy into food for all life on Earth. Without trees and plants we could not survive.

The following characteristics make a tree a tree:



1. **Trees are perennials.** A perennial means that the plant continues growing year after year, while **annuals**, such as sunflowers, grow for a single season and then die off in the fall.
2. **Trees are generally larger.** This is not always the case, there are some exceptions:



Giant Bamboo (actually a grass)



Bonsai Tree (really small trees)

3. **Trees have a self-supporting trunk.** This means that they do not need extra material to support themselves. Some plants such as the strangler fig vine can grow as tall as a tree, but it must use an existing tree to grow on in order to get that tall (in the process it kills the host tree!).
4. **Trees consist of a woody material.** In order to support tall trees, they need to grow a sturdy woody trunk to keep the tree from falling over.
5. **Trees have bark.** A protective layer other plants don't have.

T-2 Parts of a Tree

Trees can be divided into three distinct sections that each have their own function that work together in order for a tree to survive.

Crown



The crown is the upper portion of a tree where leaves and branches are found.

Leaves – These collect sunlight and are the food factories for the tree. Photosynthesis takes place in the leaves.

Branches – Branches spread the leaves in order to maximize the amount of sunlight that is collected, in turn increasing the food production by the leaves.

Fruit, Nuts and Cones – These contain and protect the seeds of a tree and help to distribute them away from the parent tree.

Flowers – Flowers produce the seeds and fruiting structures of a tree.

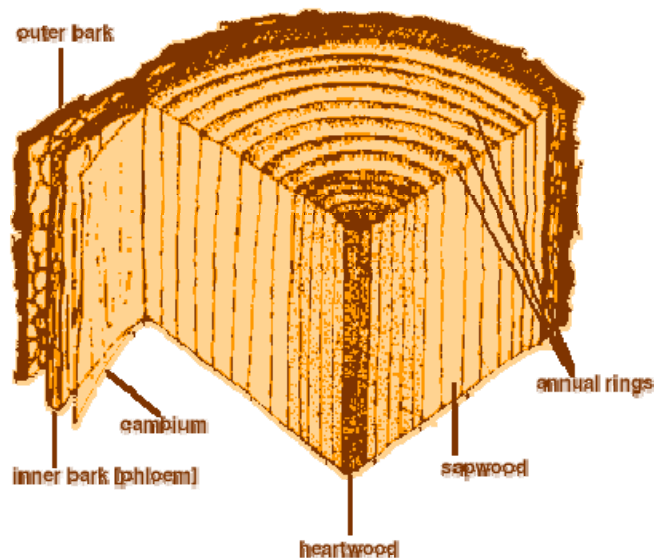
Trunk



The trunk is the main support structure for the tree. Each year the trunk grows a new set of rings, gradually increasing the width of the tree's trunk (known as **annual rings**). A light ring (**springwood**) and a dark ring (**summerwood**) are grown each year, counting these rings together you can find the age of the tree.

The structure of a tree's trunk consists of five distinct layers.

Tree Trunk Layers





Heartwood – The solid inner layer of a tree’s trunk. **Heartwood** is created from older **sapwood** cells that have been filled with mineral deposits and resins and is very hard. No life processes take place in this layer; it is basically a dead support layer.

Sapwood – This is also known as the **xylem** layer it is this layer and the heartwood together that show the annual rings. The **xylem** is similar to a set of straws that run from the roots to the leaves and transports water and **nutrients** in order for the tree to produce its own food.

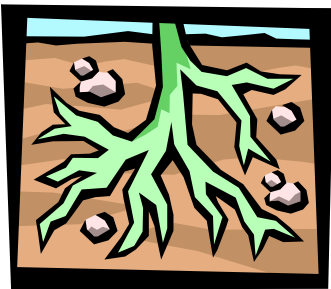
Cambium – This thin layer of a tree’s **trunk** is where all outwards growth takes place. On the inside of this layer new **sapwood** cells are created (**annual rings**), on the outside, new **phloem** cells are created. This cell growth allows the tree to widen its **trunk**.

Phloem (Inner Bark) – The **phloem** layer is where the tree moves food stores throughout the tree. Food that is produced in the **leaves** is transported to areas of new growth in other areas of the tree or for winter food storage in the roots for early spring growth.

Bark – This is the protective outer layer of a tree. It protects the tree against heat and cold and consists mainly of old **phloem** cells.



Roots

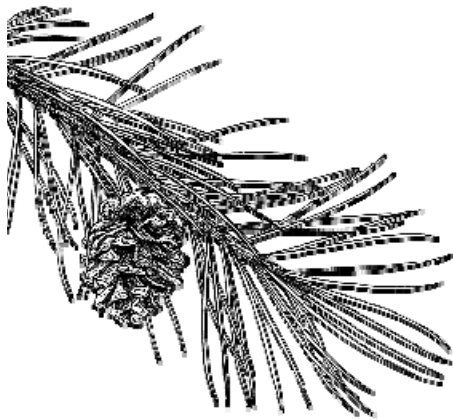


Roots – The roots anchor the tree to the ground, prevent soil erosion, collect water and absorb **nutrients** from the surrounding soil. Winter food reserves are also stored in the roots for early spring growth.

T-3 Types of Trees

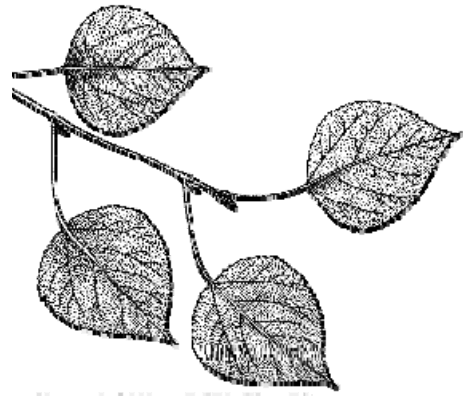
In Alberta we have two main classifications of trees. **Deciduous** trees are those trees that have leaves and use flowers and fruit to disperse their seeds. **Coniferous** trees are those trees that have needle leaves and use cones to produce seeds. One of the easiest ways to classify trees is to first divide them into these two groups. When scientists classify trees they use a tool called a **dichotomous key** (“Di-” means two). You will find one of these key later in this handout.

Coniferous



- Needles leaves
- Cones protect seeds
- Usually keep leaves over winter
- Considered a softwood product

Deciduous

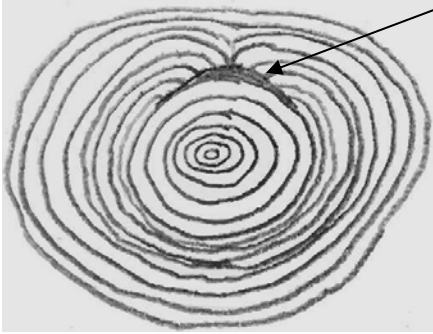


- Flat, broad leaves
- Fruit protect seeds
- Leaves fall in autumn
- Considered a Hardwood

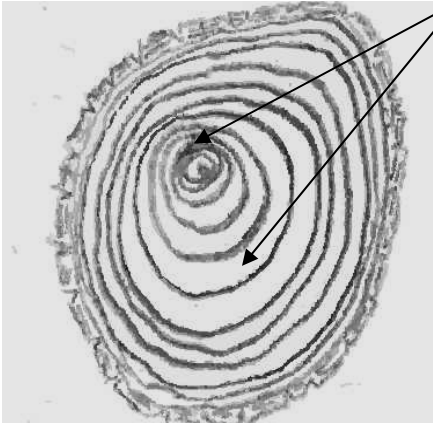
T-4 Tree Cookies (Tree Cross Sections)

Trees each year grow a set of rings; therefore you can count the rings to find out how old a tree is. Many trees have two growth seasons each year, Spring and Summer. In the spring months all trees experience the greatest amount of growth; therefore this is shown by a thicker, lighter coloured band (**springwood**). In the summer months, less growth occurs therefore the tree grows a thinner darker ring during this time (**summerwood**). In fall and winter, little or no growth usually occurs in our climate. When counting rings you must count a dark and a light ring as one year's growth.

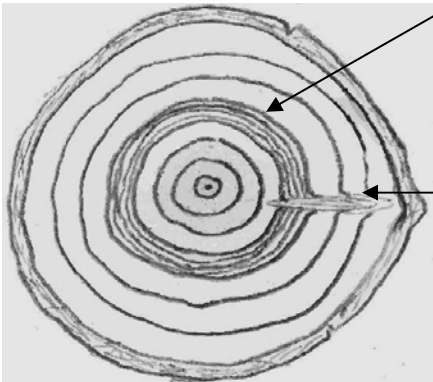
By looking for certain patterns in the rings you can identify the history of that tree and discover events that took place in the tree's past. The following diagrams show how some of these feature look.



A dark mark surrounded by a group of tree layers that seem to cover over the mark, is considered to be a major trauma on the tree. Usually caused by a forest fire, in which the tree survived.

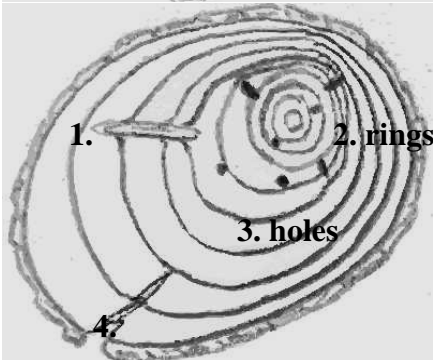


Thin rings on one side and thick on the opposite indicate that the tree is growing on a slope, where downhill is on the wide ring side. Or, the tree may have some obstruction, such as a rock or a building, on the thin side of the tree causing it to grow away. What happened when this tree was older? (hint, rings almost equal in width all the way around)



Narrow rings, indicate poor growing conditions, caused by insects, drought, or lack of light.

This break in the rings is caused by something trees need, what do you think it is?



What happened to this tree?

1.

2.

3.

4.

T-5 Photosynthesis / Transpiration / Respiration

Using a dictionary, find a definition for each of these terms. Make sure the definition applies to plants or trees.

Photosynthesis

Transpiration

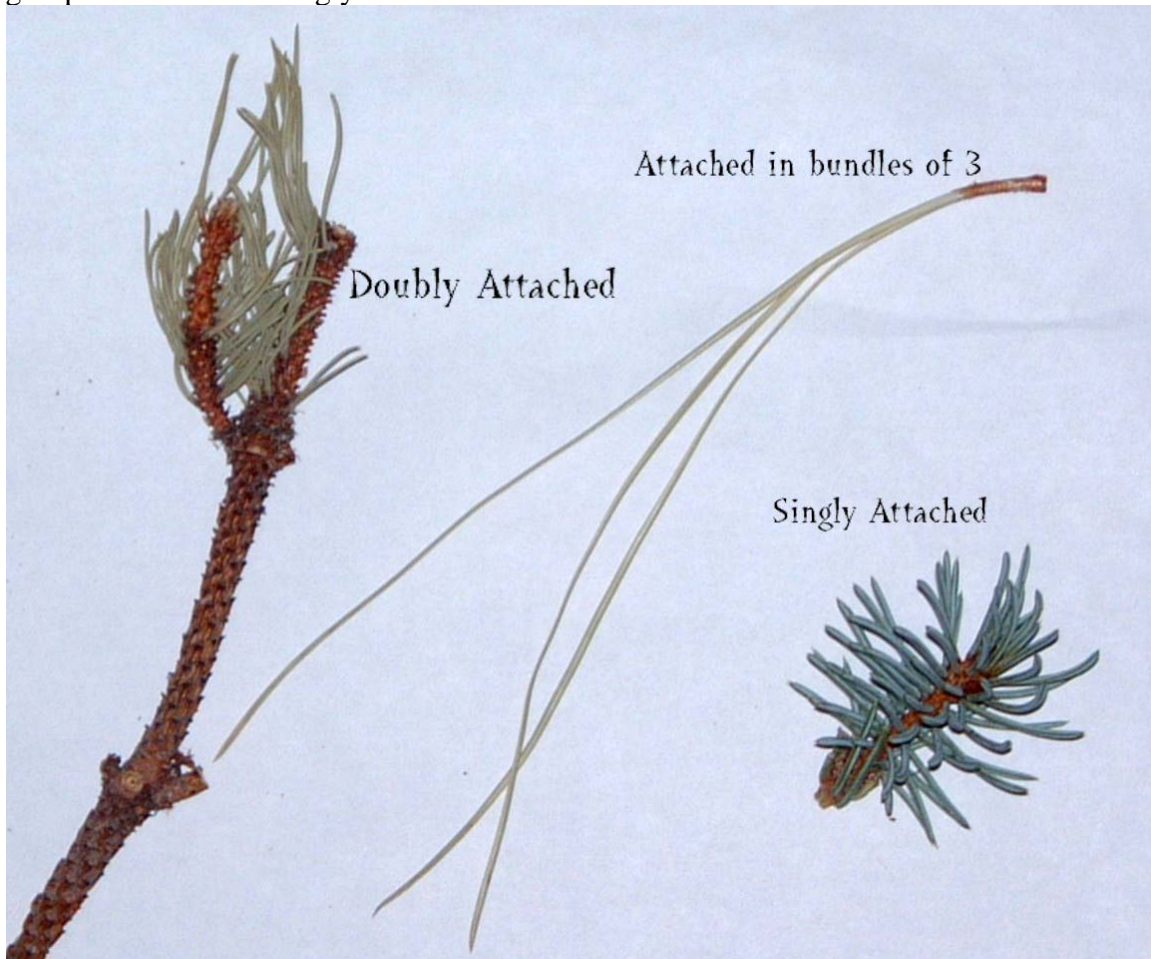
Respiration

In the below space, use the extra handout to create a diagram of how photosynthesis, transpiration and respiration are related.

T-6 Tree Identification

As mentioned earlier in the unit, scientists use dichotomous keys as a tool to help them to identify trees. These keys work by sorting trees according to different features of those trees. Some terms that you will need to know to use these keys are as follows.

Needle Attachment – How the needle is attached to a branch, needles can be attached in groups or bundles or singly.



Leaf Margin – This is the edge of the leaf, it can be considered lobed, serrated or toothed.



Serrated (toothed)



Lobed

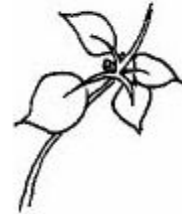
Leaf attachment – The way leaves attach to the branch of a tree also may help to identify to which family a tree belongs. The leaves may be attached in an alternate, an opposite or whorled pattern.



Alternate

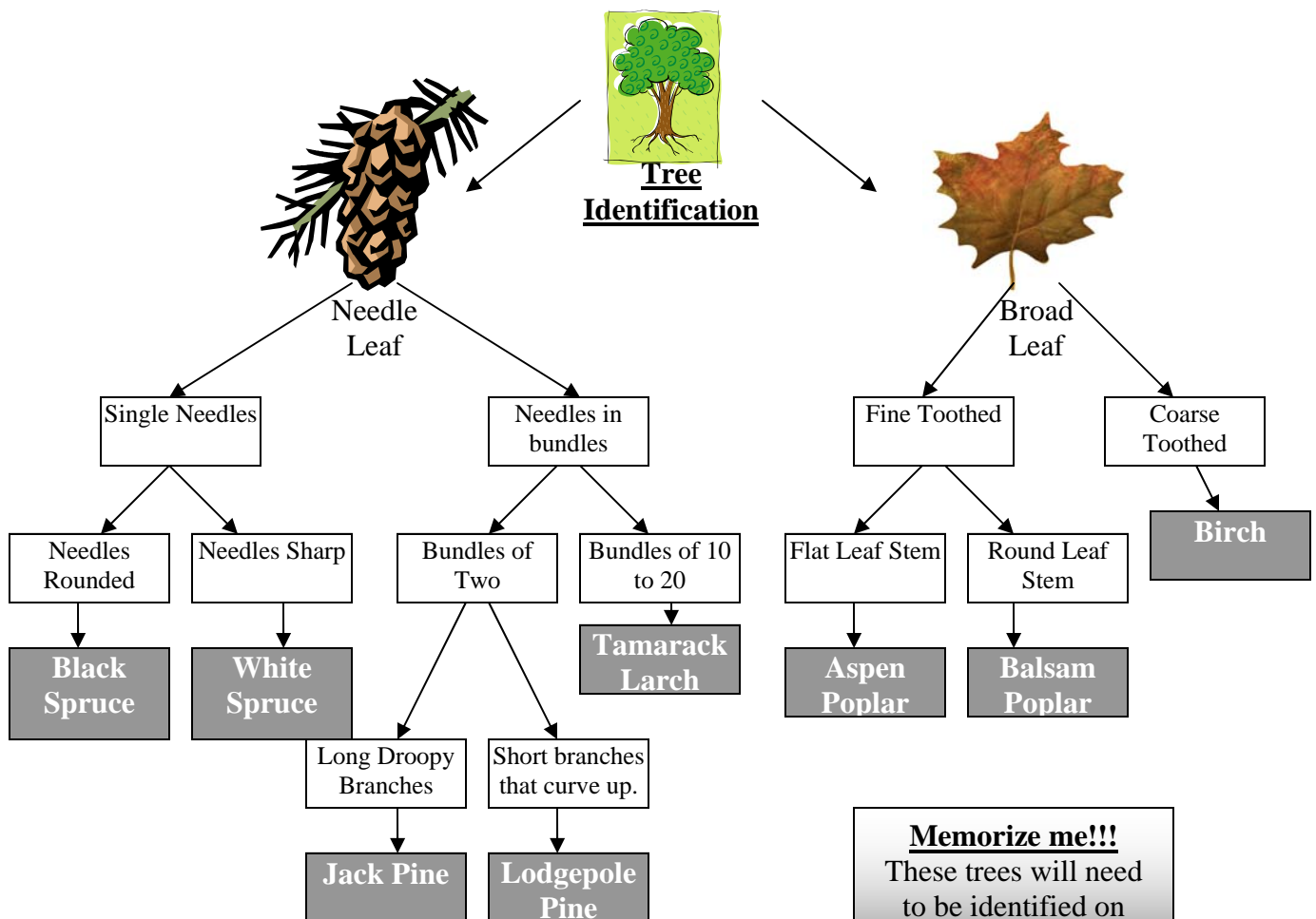


Opposite



Whorled

Using the above leaf types, you can use a tree key to help you identify trees that you find. The following tree key lists Alberta's top 8 trees.



Memorize me!!!
 These trees will need to be identified on your final test without a key like this.

T-7 Forest Management

In order to understand forest management, it is necessary to understand that forests undergo a sequence of predictable stages naturally; a type of natural forest management. Forest fires are a natural way to renew the growth in a forested region, and through suppression of forest fires, humans have interrupted the natural evolution of many forested regions. The natural stages that a forest undergoes are known as **Forest Succession**.

Natural **forest succession** begins where the original forest has disappeared due to a forest fire, or where a forest is expanding into an area in which no forest exists (such as a meadow or clearing). The first tree species that emerge are known as the **Pioneer Species** trees. These sun-loving trees, such as aspen or pine, grow quickly and fill up the open areas within a matter of 20 years. When the pioneer species trees have grown enough that the forest floor is relatively shady, shade loving trees such as the black and white spruce seeds begin to grow. When a forest is at this stage, with a mix of pioneer species and spruce trees, we call this forest a **Mixed Wood** forest. Slowly the pioneer species die out (anywhere from 60-90 years old) the longer growing spruce trees take over and you end up with an uneven aged **Climax Stage Forest** of only spruce trees.

Issues in Forest Management

When humans interfere with natural succession different issues arise with how the forest should be used. A few are listed below:

1. Clearcutting versus selective logging – Loggers argue that clearcutting is most similar to a clearing made by fire, while others argue that selectively cutting older, mature trees is a more natural way to harvest wood.
2. Recreational use of the forest versus forest industry – No one wants to have a forest operation behind their mountain cottage, however Albertans need forest products in our daily lives. Balancing the needs of industry and recreational use of the forest can cause conflict.
3. Controlled burns – Should we routinely allow controlled burns in forested areas to renew the forest?