

## **Unit A:** Introduction to Forestry

### **Lesson 4:** Recognizing the Steps to Identifying Tree Species

**Student Learning Objectives:** Instruction in this lesson should result in students achieving the following objectives:

1. Explain tree taxonomy.
2. Describe hardiness zones and their importance.
3. Explain tree identification.

**Recommended Teaching Time:** 3 hours

**Recommended Resources:** The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- <http://www.uwsp.edu/cnr/leaf/Treekey/tkframe.htm>
- <http://www.oplin.org/tree/>
- <https://www.msu.edu/~nixonjos/armadillo/taxonomy.html>

### **List of Equipment, Tools, Supplies, and Facilities**

Writing surface  
PowerPoint Projector  
PowerPoint slides  
Transparency Masters  
Lab sheets for students  
Tree samples

**Terms:** The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Angiosperms
- Dehiscent fruits
- Dichotomous venation
- Dioecious
- Gymnosperms
- Hardiness
- Indehiscent fruits
- Inflorescence
- Leaf venation
- Monoecious
- Palmate
- Parallel venation
- Pinnate
- Polygamo-dioecious
- Polygamo-monoecious
- Taxonomy

**Interest Approach:** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Have different tree samples on display. Ask students to identify differences between them. Direct the class discussion toward the proper methods of tree identification

## Summary of Content and Teaching Strategies

**Objective 1:** Explain tree taxonomy.

**(PowerPoint Slide #3)**

I. Common names of trees vary from region to region. The use of scientific names helps avoid confusion in tree identification.

**(PowerPoint Slide #4)**

A. **Taxonomy** is the classification of plants according to natural relationships.

1. Trees are members of the plant kingdom and are placed into divisions, classes, subclasses, orders, families, genera, and species.

**(PowerPoint Slide #5)**

- a. Carl von Linne (Linnaeus), a Swedish botanist, was the first to use this system of classifying plants and he is referred to as the father of the systematic botany.

**(PowerPoint Slide #6)**

- b. There are two divisions: Pinophyta and Magnoliophyta.

1. The coniferous species make up the Pinophyta and the trees in this division are called gymnosperms.

- a. **Gymnosperms** are plants that bear naked seeds without an ovary.

**(PowerPoint Slide #7)**

2. The broad-leaved species make up the Magnoliophyta and the trees in this division are called angiosperms.

- a. **Angiosperms** are plants having seeds borne within a pericarp.

**\*\*Use TM: A4-1 or PowerPoint Slide # 8 as material for lecture and discussion. You could also assign a student a tree and have them find out the scientific classification.**

**Objective 2:** Describe hardiness zones and their importance.

**(PowerPoint Slide #9)**

II. **Hardiness** is the plants ability to with stand winter stress. Hardiness ratings are risky since many factors other than low temperatures affect plant survival in a specific area.

- A. Hardiness is measured using a plant hardiness zone map. Each area of the world is assigned a zone numbered from one to thirteen. Hardiness zones are derived from the average coldest temperatures for the year.

**(PowerPoint Slide #10)**

The 13 hardiness zones are defined as followed:

- Zone 1: below -46 C (below -50 F)
- Zone 2: -46 to -40 C (-50 to -40 F)
- Zone 3: -40 to -34 C (-40 to -30 F)
- Zone 4: -34 to -29 C (-30 to -20 F)
- Zone 5: -29 to -23 C (-20 to -10 F)
- Zone 6: -23 to -18 C (-10 to 0 F)
- Zone 7: -18 to -12 C (0 to 10 F)
- Zone 8: -12 to -7 C (10 to 20 F)
- Zone 9: -7 to -1 C (20 to 30 F)
- Zone 10: -1 to 4 C (30 to 40 F)
- Zone 11: 4 to 10 C (40 to 50 F)
- Zone 12: 10 to 15 C (50 to 60 F)
- Zone 13: above 15 C (above 60 F).

**(PowerPoint Slide #11)**

B. Hardiness ratings are meant only as a guide and should not be looked upon as a limiting factor in plant use.

1. Large bodies of water, well-drained soil, wind protection, and adequate moisture will help to increase hardiness.
2. Hardiness is a dual-edged sword, for heat, like cold, can limit successful growth of certain plants.

**\*\* Show students the hardiness zone map on TM: A4-2 or PowerPoint Slide #12. Use the temperatures list for each zone to show the zone temperatures for your area.**

**Objective 3:** Explain tree identification.

**(PowerPoint Slide #13)**

III. In order to successfully identify woody plants it is necessary to have a working knowledge of taxonomic terminology and concise mental pictures of leaf, bud, stem, flower and fruit morphology.

**(PowerPoint Slide #14)**

A. The leaf, twig, bark and fruit are the most commonly used characteristics for tree identification. Each kind of tree, whether broad-leaved or coniferous, has certain characteristics that make it distinctive from another species.

**(PowerPoint Slide #15)**

1. Most trees can be identified by the type, size, shape, color, texture, and arrangement of leaves.

**(PowerPoint Slide #16)**

- a. Trees will have leaves (angiosperms) or needles (gymnosperms).
  1. For trees with leaves, the leaves are either simple or compound.
    - a. Simple leaves have a bud located in the axil of a single leaf and stem.
    - b. Compound leaves have a bud located in the axil of a structure with more than one leaf.

**(PowerPoint Slide #17)**

1. Palmately compound leaves have each leaflet attached at a common point.

2. Pinnately compound leaves can have either odd or even number of leaflets.

**(PowerPoint Slide #18)**

- c. The arrangement of leaves and buds can be used as a basis for separation.
  1. Leaves and buds directly across from each other on the stem are called opposite.
  2. Leaves and buds that are spaced in alternating fashion along the axis of the stem and seldom, if ever, are seated directly across from each other are known as alternate.

**(PowerPoint Slide #19)**

3. Subopposite refers to a condition where the leaves and buds are not spaced sufficiently far apart to be considered alternate nor are they perfectly opposite.
4. Whorled refers to a condition when three or more buds and leaves are present at a node.

**(PowerPoint Slide #20 shows examples of angiosperm leaf types. PowerPoint Slide #21 shows leaf arrangement.)**

**(PowerPoint Slide #22)**

- d. The arrangement of veins in a leaf is known as **leaf venation**.
  1. If the leaf has a prominent central vein or midrib that extends from the base, where the petiole attaches to the blade, to the apex of the leaf it is known as **pinnate**.

**(PowerPoint Slide #23)**

2. If there are several main veins all of approximately equal size that extend from the base of the leaf to the apex of the lobe or margin of leaf it is known as **palmate**.

**(PowerPoint Slide #24)**

3. **Dichotomous venation** is when the basal veins extend for a distance and then branch forming a “Y” type pattern.
4. When the veins run essentially parallel to each other along the long axis of the leaf it is called **parallel venation**.

**(PowerPoint Slide # 25 shows leaf venation.)**

**(PowerPoint Slide #26)**

- e. There is a tremendous quantity of terminology related to leaf shapes, bases, margins and apices.

**(PowerPoint Slide #27)**

2. Trees with needles can be awl-like, scale-like or needle-like.
  - a. Needles that are shaped like an awl are usually very sharp to the touch.
  - b. Scale-like foliage overlaps like the shingles on a roof or the scales on a fish. This type of foliage is relatively soft to the touch.

**(PowerPoint Slide #28)**

- c. Needle-like foliage can be born singly or in clusters along the stem. The needles may be relatively flat (2-sided) or angular in cross-section.

**(PowerPoint Slide #29 shows gymnosperm leaf types.)**

**(PowerPoint Slide #30)**

2. During the autumn and winter season tree identification must be based on stem, bud and bark characters. Buds and stems offer the principal means of identification.

**(PowerPoint Slide #31)**

- a. The shape, size, color and texture of buds offer interesting identification characters.
- b. Leaf scars often provide distinguishing identification characters. Both the shape and vascular bundle arrangement are often used to separate plants.

**(PowerPoint Slide #32 shows the leaf forms.)**

**(PowerPoint Slide #33)**

- c. Lenticels, lip-shaped structures composed of corky cells, are produced through the action of a cork cambium. They are beneficial for identification due to their different colors and sizes.
- d. Bud scales by their size, color, shape or markings offer good characters for identification.

**(PowerPoint Slide #34)**

- e. Terminal bud scale scar is the place where the previous year's bud scales were attached. As the buds open and expand in spring the scales abscise and leave a distinct scar around the stem. This scar can be useful for gauging the amount of linear growth in a particular season or over a number of seasons.

**(PowerPoint Slide #35)**

- f. Pith is a very valuable plant tissue for separating closely related plants. Pith is derived from a primary meristem and is usually vestigial. The color and texture of pith can often be used for separating similar plant types.

**(PowerPoint Slide #36)**

3. On deciduous trees, bark is the most important identification feature in the dormant winter period.
  - a. Bark varies in thickness, roughness, type of fissures, and color.

**(PowerPoint Slide #37)**

- b. Each year the cambium lays down an annual ring of new cork cells (bark), forcing the old bark outward.

**(PowerPoint Slide #38)**

Since the outer bark cannot stretch, it fissures or cracks into plates, ridges, and scales, forming the bark characteristic of each species.

**(PowerPoint Slide #39 shows the stem and bud morphology.)**

**(PowerPoint Slide #40)**

4. Flowers are important components to positive tree identification. The flowering periods of most woody plants average seven to fourteen days.
  - a. There are numerous variations in flower shape but the reproductive parts, stamens and pistils are essentially similar.

**(PowerPoint Slide #41)**

1. Flower that has all the parts (sepals, petals, stamens, and a pistil or pistils) is called complete.
2. Incomplete flowers lack one or more whorls of floral parts.
3. Imperfect flowers lack either stamens or pistils.
4. Perfect flowers have both stamens and pistils.

**(PowerPoint Slide #42)**

5. ***Monoecious*** means that staminate and pistillate flowers are present on the same plant but in different structures.
6. ***Dioecious*** means the staminate and pistillate flowers are borne on different plants.

**(PowerPoint Slide #43)**

7. ***Polygamo-monoecious*** refers to a condition where perfect, pistillate and staminate flowers occur on the same tree.
8. ***Polygamo-dioecious*** implies perfect and pistillate flowers on the same plant or perfect and staminate flowers.

**(PowerPoint Slide #44 shows a picture of the flower structure.)**

**(PowerPoint Slide #45)**

- b. Flowers are borne on structures that are referred to as inflorescences. An ***inflorescence*** is a collection of individual flowers arranged in some specific fashion.

**(PowerPoint Slide #46)**

1. There are several types of inflorescence.
  - a. Spike has individual flowers that are sessile on the elongated axis (peduncle).
  - b. Raceme is a modification of a spike with the individual flowers stalked on a pedicel.

**(PowerPoint Slide #47)**

- c. Corymb is an indeterminate inflorescence in which the individual flowers are attached at different points along the peduncle. The outer flowers open first.

**(PowerPoint Slide #48)**

- d. Umbel is an indeterminate inflorescence in which the pedicels of the individual flowers radiate from about the same place at the top of the peduncle. Flowers open from outside in.

**(PowerPoint Slide #49)**

- e. Cyme is a determinate, flat or convex inflorescence, the central or inner flowers opening first.
- f. Panicle is an indeterminate inflorescence with repeated branching. Panicles can be made up of many racemes, spikes, corymbs, cymes or umbels.

**(PowerPoint Slide #50)**

- g. Solitary indicates a single flower with a pedicel attached to the stem.
- h. Head is made up of ray (sterile) and disk (fertile) flowers which are arranged on a flattened receptacle.

**(PowerPoint Slide #51)**

- i. A spadix is a specialized type of inflorescence typical of many tropical plants. The showy part is the bract or spathe while the spike-like structure which is partially surrounded by the spathe bears the fertile flowers.

**(PowerPoint Slide #52 shows the different types of inflorescences.)**

**(PowerPoint Slide #53)**

5. Fruits are very important considerations in woody landscape plants for they offer good ornamental assets and positive identification features.

- a. The longitudinal section of the typical flower offers representative view of the ovary. The ovary is the forerunner of the fruit and is defined as an unripened fruit.

**(PowerPoint Slide #54)**

1. The ovary is composed of carpel(s) which are highly modified leaflike structures, which enclose ovules (forerunner of seeds).

- b. Simple fruits consist of a single enlarged ovary composed of one carpel.

**(PowerPoint Slide #55)**

1. Simple fruits can be divided into two major groups: dry and fleshy.

- a. Dry fruits can be divided into indehiscent and dehiscent.

1. **Indehiscent fruits** are those that do not split open at maturity.

There are several types.

**(PowerPoint Slide #56)**

- a. Achene is a one-seeded fruit with seed attached at only one place to the pericarp. The pericarp is very close fitting and does not split open, at least along regular established lines.

- b. Caryopsis is similar to an achene but the pericarp is adherent to the seed, the two often being indistinguishable.

**(PowerPoint Slide #57)**

- c. Samara is usually one seeded with a membranous wing, which develops from the pericarp.

- d. Nut is a bony, hard, one-seeded fruit. The pericarp is bony throughout.

**(PowerPoint Slide #58)**

- e. Utricle is similar to an achene but the ovary wall is relatively thin and inflated so it fits only loosely around the seed.

- f. Nutlet is diminutive of nut.

**(PowerPoint Slide #59)**

2. **Dehiscent fruits** split open when mature. There are several types.

- a. Legume (pod) is composed on one carpel and opens along two sutures

- b. Follicle is composed of one carpel but splits open at maturity along one suture exposing several seeds.

**(PowerPoint Slide #60)**

- c. Capsule is many-seeded fruits formed from more than one carpel. The carpels are united.

- d. Silique is composed on two carpels, which separate at maturity, leaving a thin partition.

- e. Sillicle is a short, broad silique.

- f. Pyxis is a type of capsule, which opens around a horizontal ring, the top of fruit falling away like a lid.

**(PowerPoint Slide #61)**

- b. There are several types of fleshy fruits.

1. When the entire pericarp is fleshy it is called berry. There are two types of berry fruits.
  - a. Hesperidium has a berry with a leathery rind.
  - b. Pepo is a berry with a hard rind and a fleshy inner matrix.

**(PowerPoint Slide #62)**

2. Drupe is when the pericarp is clearly differentiated into three layers.
  - a. Exocarp is the epidermis.
  - b. Mesocarp is the middle, fleshy layer.
  - c. Endocarp is the stony, inner layer.

**(PowerPoint Slide #63)**

3. Pome is when the pericarp is surrounded by the floral tube that becomes fleshy and tasty.
- c. Aggregate fruits consist of two or more carpels. Develop from a single flower which contains many pistils. Several fruitlets are massed on one receptacle.
- d. Multiple fruits consist of several flowers which are more or less united into one mass.

**\*\*Use TM: A4-3, TM: A4-4, TM:A4-5, TM:A4-6, TM:A4-7, TM:A4-8, and TM:A4-9 as material for lecture and discussion. Also show students examples of leaves and have them explain the leaf patterns, venation, etc. Do this similar activity with different flowers and fruits as well. LS: A4-1 will help students practice identifying trees. There is a lot of information in this objective you may have to go back and review in order for the students to retain everything.**

**Review/Summary:** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. The Objectives on PowerPoint Slide #64 can also be used.

**Application:** LS: A4-1 will help students practice identifying trees.

**Evaluation:** Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

## Answers to Sample Test:

### ***Part One: Matching***

1. f
2. a
3. g
4. c
5. d
6. b
7. h
8. i
9. e
10. j

### ***Part Two: Completion***

1. angiosperms, gymnosperms
2. bark
3. inflorescences
4. gymnosperms
5. palmate
6. parallel
7. Pinophyta and Magnoliophyta
8. angiosperms

### ***Part Three: Short Answer***

1. leaves, twig, bark and fruit
2. The flowering periods of most woody plants is short, usually with an average of seven to fourteen days.
3. There are many factors other than low temperatures affect plant survival in a specific area.

# Test

## Unit A Lesson 4: Recognizing the Steps to Identifying Tree Species

**Part One: Matching**

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- |                          |                  |               |
|--------------------------|------------------|---------------|
| a. dehiscent             | e. indehiscent   | h. monoecious |
| b. dichotomous venation  | f. leaf venation | i. pinnate    |
| c. dioecious g. Linnaeus | j. taxonomy      |               |
| d. hardiness             |                  |               |

- \_\_\_\_\_ 1. The arrangement of veins in leaf.
- \_\_\_\_\_ 2. Fruits that split open when mature.
- \_\_\_\_\_ 3. Father of the systematic botany.
- \_\_\_\_\_ 4. Staminate and pistillate flowers are borne on different plants.
- \_\_\_\_\_ 5. Plants ability to with stand winter stress.
- \_\_\_\_\_ 6. Basal veins extend for a distance, then branch forming a “Y” pattern.
- \_\_\_\_\_ 7. Staminate and pistillate flowers are present on the same plant but in different structures.
- \_\_\_\_\_ 8. Leaf has a prominent central vein or midrib that extends from the base to the apex of the leaf.
- \_\_\_\_\_ 9. Fruits that do not split open at maturity.
- \_\_\_\_\_ 10. Classification of plants according to natural relationships.

**Part Two: Completion**

*Instructions.* Provide the word or words to complete the following statements.

- 1. Trees that will have leaves are \_\_\_\_\_ and trees that have needles \_\_\_\_\_.
- 2. On deciduous trees in the dormant winter period, \_\_\_\_\_ is the most important identification feature.
- 3. Flowers borne on structures are referred to as \_\_\_\_\_, which is a collection of individual flowers arranged in some specific fashion.

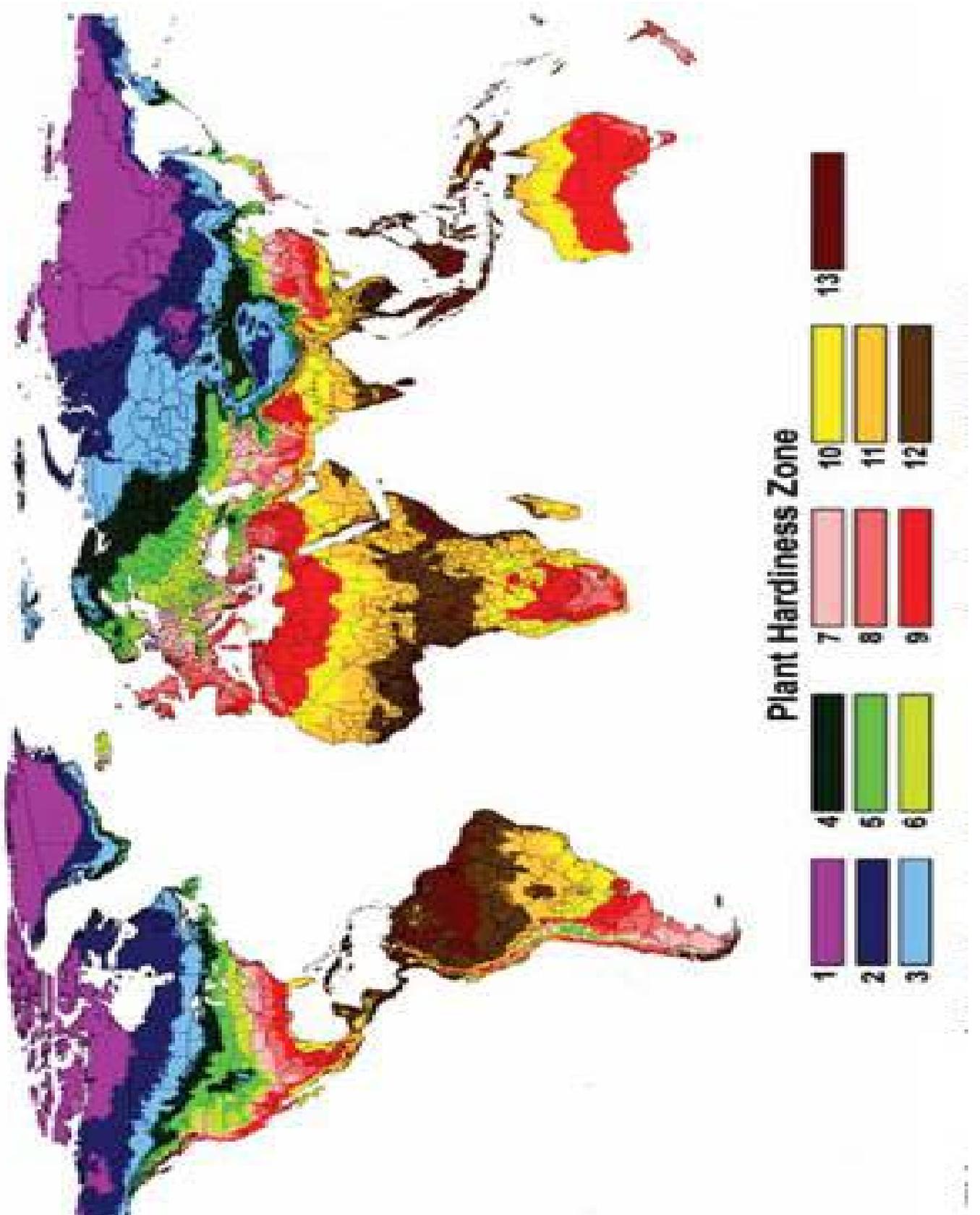


TM: A4-1

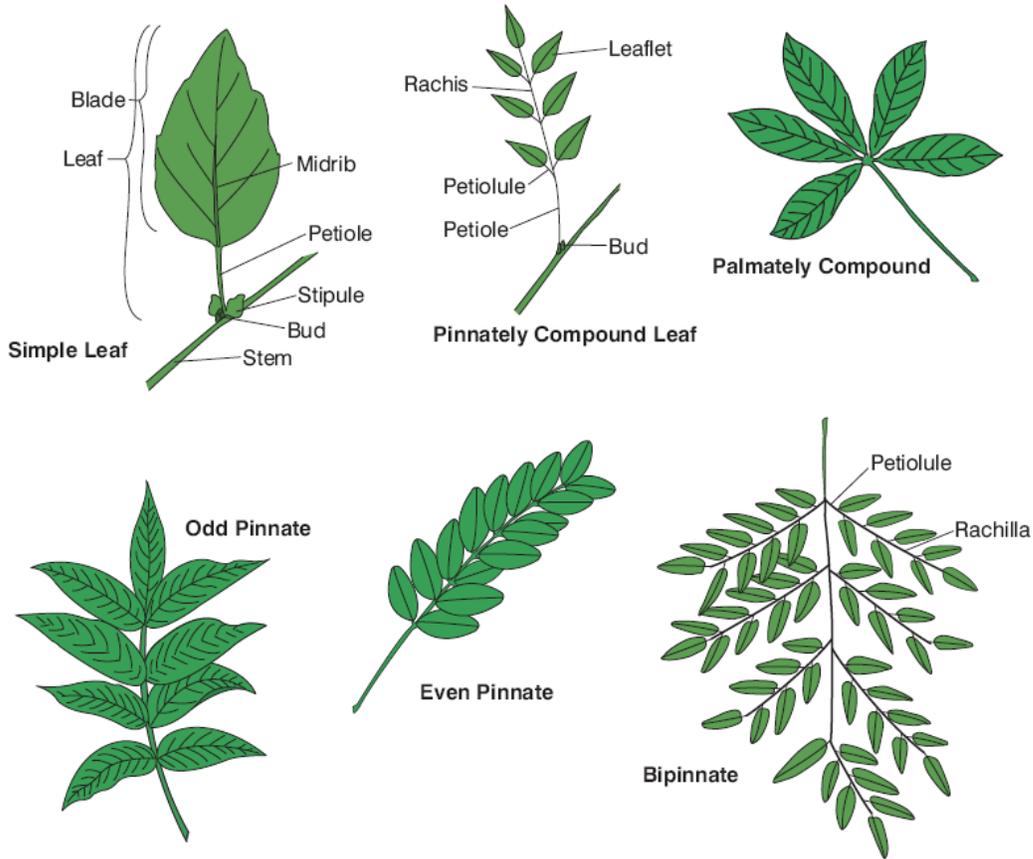
## SCIENTIFIC NAMES

	<b>Loblolly Pine</b>	<b>White Oak</b>
<b>Division</b>	<b>Pinophyta</b>	<b>Magnoliophyta</b>
<b>Class</b>	<b>Pinopsida</b>	<b>Magnoliopsida</b>
<b>Subclass</b>		<b>Magnoliidae</b>
<b>Order</b>	<b>Pinales</b>	<b>Fagales</b>
<b>Family</b>	<b>Pinaceae</b>	<b>Fagaceae</b>
<b>Genus</b>	<i>Pinus</i>	<i>Quercus</i>
<b>Species</b>	<i>taeda</i>	<i>alba</i>

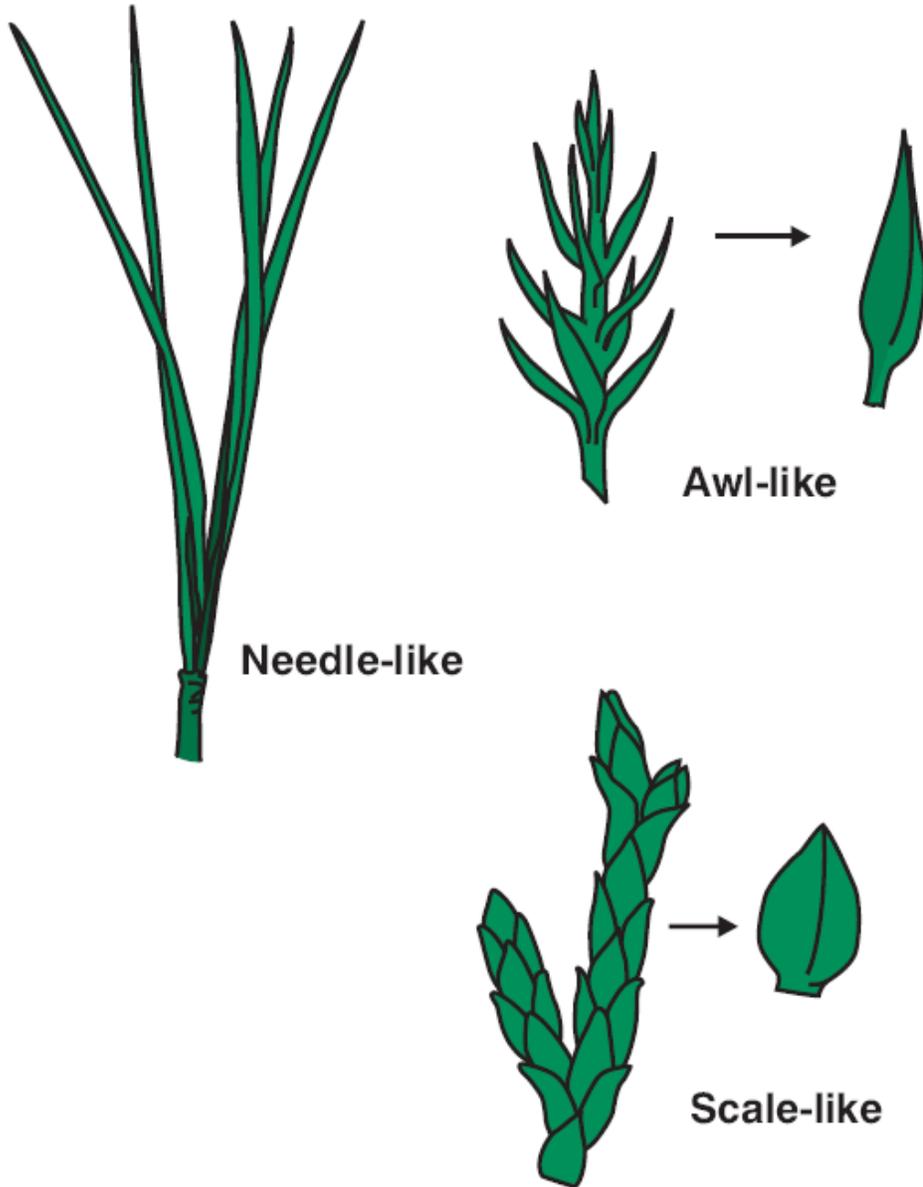
# HARDINESS ZONES



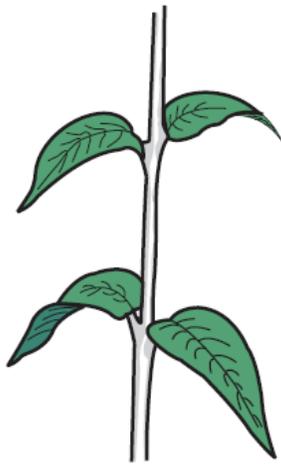
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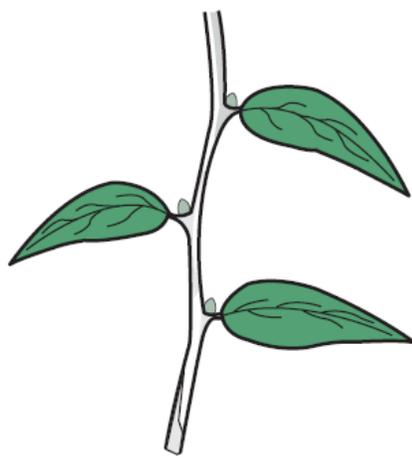
# GYMNOSPERM LEAF TYPES



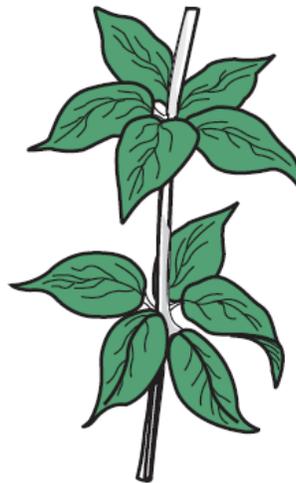
## LEAF ARRANGEMENT



**Opposite**



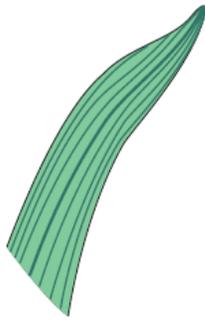
**Alternate**



**Whorled**

*(Interstate Publishers, Inc.)*

# LEAF VENATION



Parallel  
Venation



Pinnate  
Venation

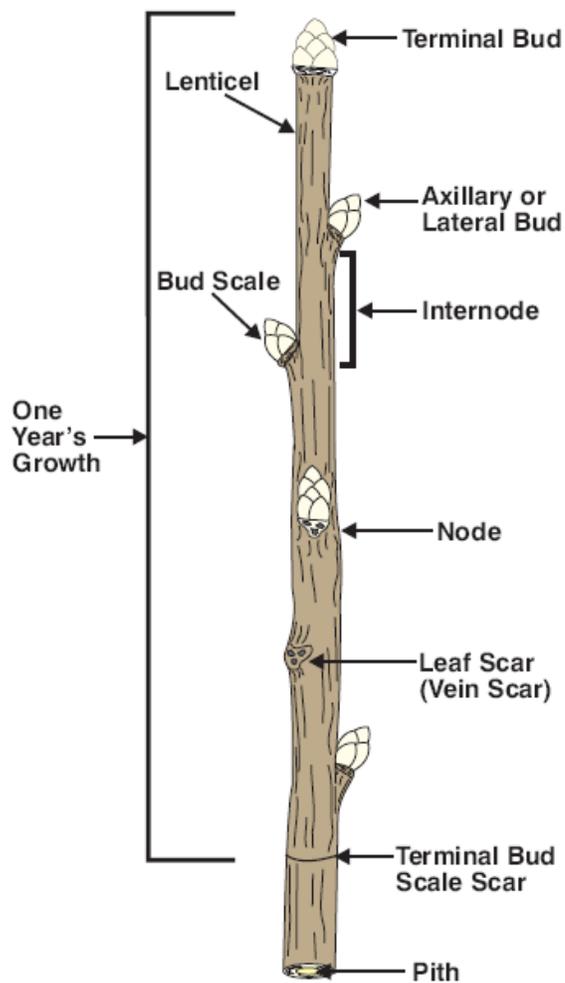


Palmate  
Venation

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TM: A4-7

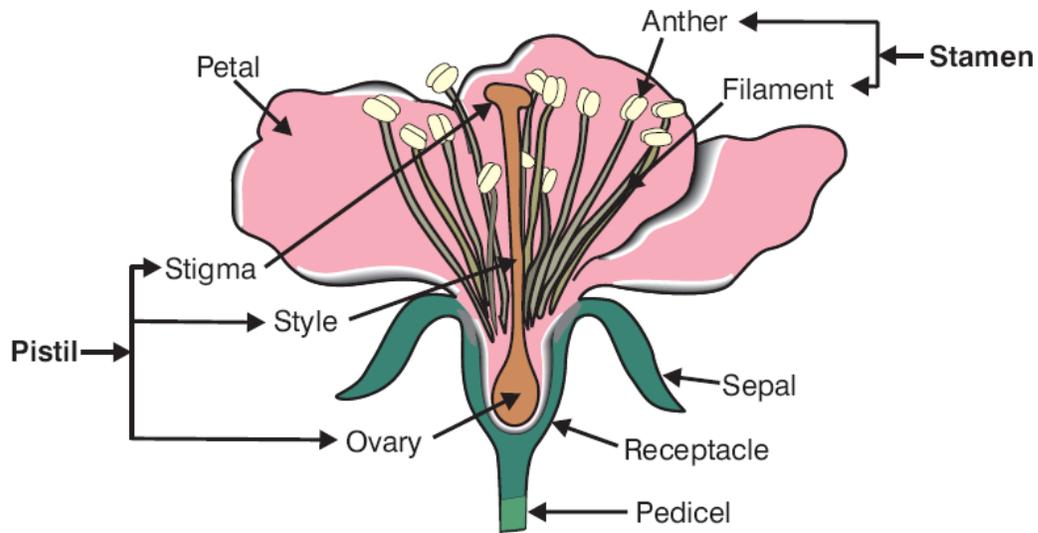
# STEM AND BUD MORPHOLOGY AND TYPES OF PITH



(Interstate Publishers, Inc.)

TM: A4-8

## FLOWER STRUCTURE



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# TYPES OF INFLORESCENCES



Solitary



Spike



Raceme



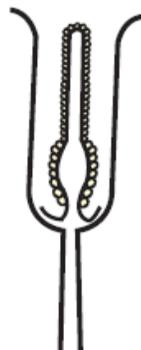
Panicle



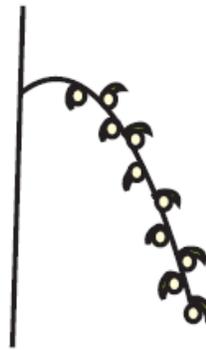
Corymb



Umbel



Spadix



Catkin



Head

**LS: A4-1**

Name: \_\_\_\_\_

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# Lab Sheet

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## Tree Identification

***Equipment:***

Tree Finder Book or similar reference

Trees (5 to 10)

Notebook with paper and writing instrument

***Procedure:***

Using the identification reference, determine the name of the given trees. Write all the steps taken to arrive at the name of the tree.