Lecture 3

Tree Identification

The identification of trees is the third aspect of tree taxonomy or classification. Trees are classified into groups primarily by their fruits and flowers, but the leaves and twigs are usually more accessible for identification. Tree identification in urban locations requires knowing many trees because of the numerous exotics that have been introduced from around the country and the world.

The most important features to look for in identifying a tree are:

A- Leaves.

B- Twigs And Stems.

C- Bark.

D- Flowers.

E- Fruit And Seeds.

F- Cones.

Trees are identified by several different methods. Parts of a tree may be compared to illustrations in a manual, although this can be time consuming. A better way is to use keys specifically designed to aid in identifying trees.

Keys; are tools that lead the user through the steps of identification based on the features of the tree. The key often focuses on the fruit or flower since this is the primary means for classifying trees. However, keys have also been developed for other features such as leaves, stems, buds and bark.

A- Leaves

One way to identify a tree is by its leaves. Leaves have many distinguishing characteristics and these characteristics can be used for identification. Each of these features will be defined and illustrated in this unit:

1. leaf Part
2. leaf Type
3. leaf Shape
4. leaf Arrangement on the stem
5. leaf Venation
6. leaf Shape of apex and base
7. leaf Margin
8. leaf Surface

1. Leaf parts

Knowing the parts of a leaf will help with tree identification (figure 1).

- The lamina is the blade or broad part of the leaf.
- The leaf is attached to the twig with a supporting stalk called a petiole. It may be either short or long, grow in a variety of different shapes, and may not exist in some trees. Some petioles enclose next season's bud in the base. When the leaf is attached directly to the twig, rather than to the petiole, it is said to be sessile.
- Stipules are a pair of small, scaly or leaf-like organs that may be attached to the twig on either side of the petiole. Some stipules will leave scars that are visible on the twig in the winter. Plants that have stipules are called stipulate, while those without them are called estipulate.

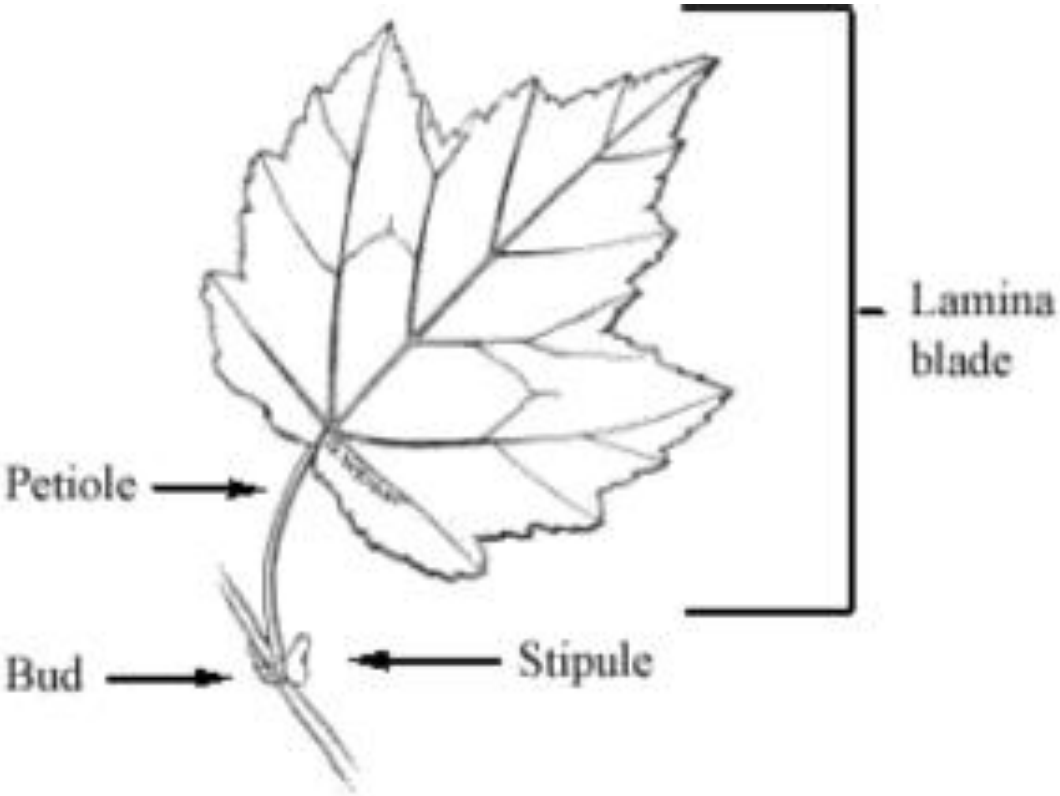

Figure 1.
Parts of a simple leaf. *(Illustration by Gene Wright)*

2. Leaf types

Determining the type of leaf can be the first step in tree identification. There are two different leaf types, hardwood and softwood.

A– **Hardwoods** can have either a simple or a compound leaf. A simple leaf has a single blade or lamina, as shown in figure 1. A compound leaf has two or more blades that are called leaflets. The stalk to which the blades are attached is called a rachis**.** The arrangement of the leaflets on the rachis determines the particular type of compound leaf. There are several types of compound leaves, which are described in figures 2,3,4, 5 and 6.

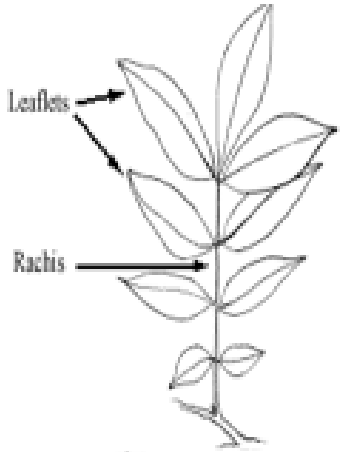

Figure 2. A pinnately compound leaf has leaflets arranged laterally on the rachis. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

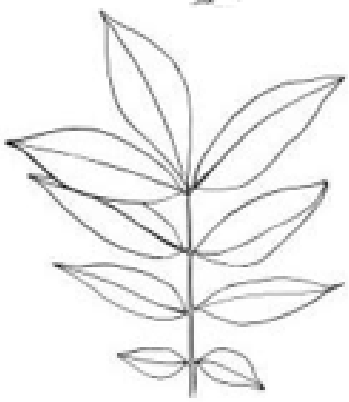

Figure 3. A leaf with an odd number of leaflets on the rachis is called an odd pinnate leaf. A boxelder tree has odd pinnate leaves. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 4. A leaf with an even number of leaflets is called an even pinnate, such as the hornless common honeylocust. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 5. A bipinnately compound leaf has multiple leaflets attached to a leaf-bearing stalk off the rachis, such as the Kentucky coffeetree. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

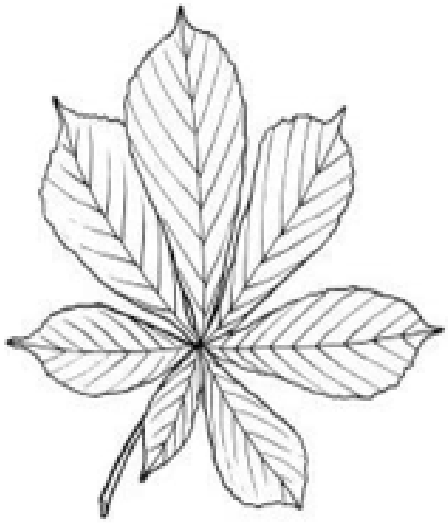

Figure 6. A palmately compound leaf has each leaflet attached to a common point, such as the Virginia creeper. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

B- Softwoods, such as conifers, usually have different leaf types than hardwoods. Not all softwoods have evergreen foliage. The three types of softwood leaves are awl-like (figure7), scale-like (figure 8), and needle-like (figure 9).

Figure 7. Awl-like needles are elongated, taper to a fine point, and are usually sharp to the touch. Many Junipers have awl-like shaped foliage. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 8. Scale-like foliage overlaps like the shingles on a roof or the scales of a fish. This type of foliage often feels soft when touched. The eastern red cedar has this type of foliage. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 9. Needle-like foliage, like that of the pine family, is found on several evergreen genera and species. Needles may be flat or angular in cross-section. The number of needles and the length of the needles may also help in identification. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

3- Leaf shape

The shape of the leaf is very useful in tree identification and is usually the same on all trees in a species. Determined by the outline of the blade of the leaf, there are several different shapes, some of which are shown in figure 10. Leaflets on a compound leaf may have two different shapes, depending whether they are located on the side or tip of the stalk.

Ovate Lanceolate Cordate Spatulate Ellipitcal Obovate Oblanceolate

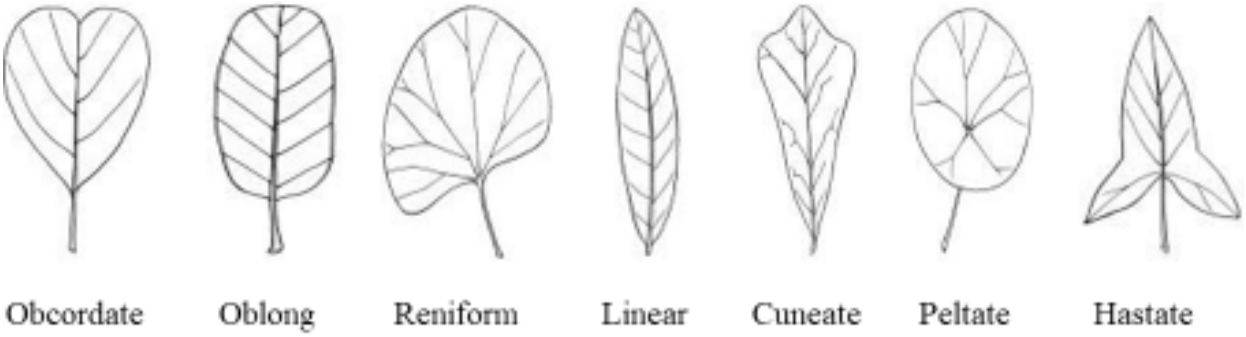

Figure 10. Examples of different types of leaf shapes. *(Illustrations adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

4- Leaf arrangement

Observing how leaves are arranged on a twig may assist in tree identification. Hardwood leaves are arranged in one of three ways, opposite (figure 11), whorled (figure 12) and alternate (figure 13).

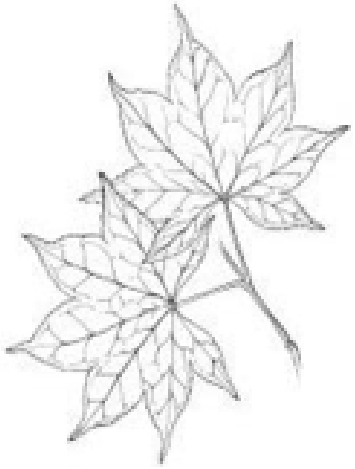

Figure 11. Opposite leaf arrangement refers to leaves that are even with each other on opposite sides of the twig. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 12. Three or more leaves found at the same node, or bud, on a twig are whorled. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 13. Alternate leaf arrangement occurs when one leaf is attached at each node, arranged in a spiral pattern around the twig. *(Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

5- Leaf venation

The venation, or the pattern of the veins, may help in identifying hardwood trees. The four primary venation patterns are pinnate (figure 14), palmate (figure 15), parallel (figure 16), and dichotomous (figure 17).

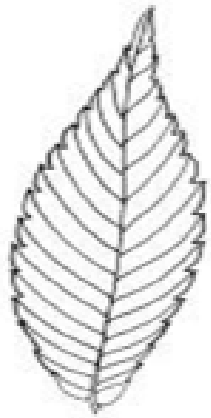

Figure 14. *Pinnate venation has a prominent central vein that extends from the base, where the petiole attaches to the blade, to the apex or tip of the leaf. The overall effect is that of a fishbone. (Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 15. *Palmate venation is when three or more veins branch from the base of a leaf. (Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 16. *The veins run parallel to each other along the length of the leaf in parallel venation. (Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

Figure 17. *With dichotomous venation the veins extend for a distance forming a "Y" type pattern. It is found in a imited number of leaves. (Illustration adopted from "Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses" (Dirr 1990); Illustration drawn by Gene Wright)*

6- Leaf apex and base

The tip of a blade that is farthest from the petiole, or stalk, is called the apex. The part of the blade nearest to the petiole is called the base. Examples of common shapes for apices and bases are shown in figures 18 and 19.

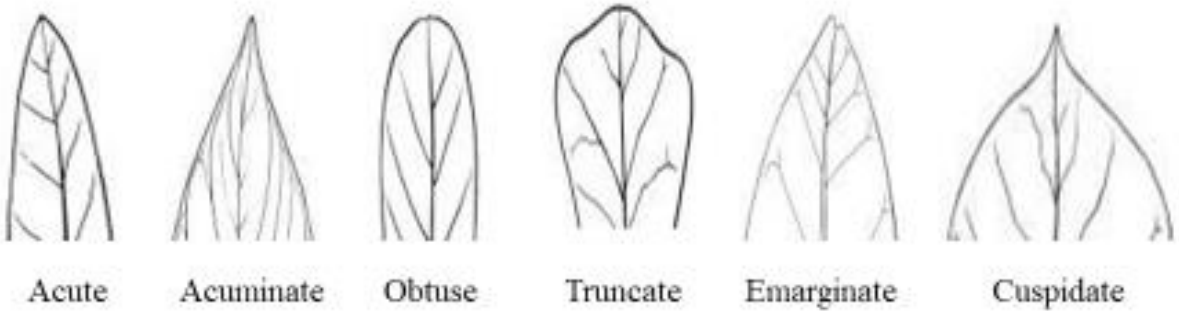

Figure 18. *Common shapes for apices of leaves.*

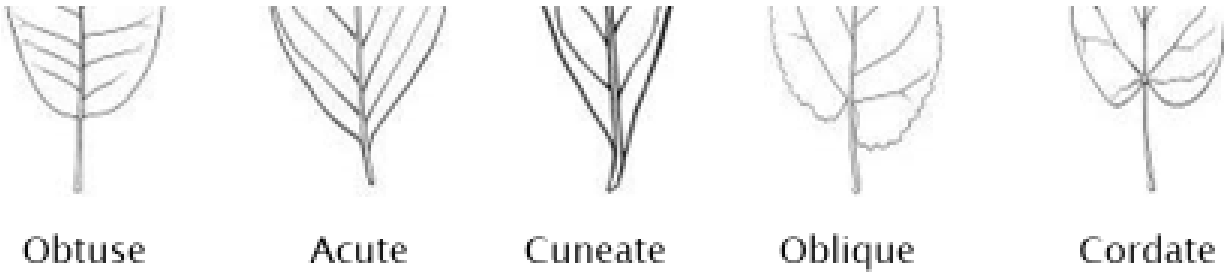

Figure 19. *Common shapes for bases of leaves.*

7- Leaf margin

The edge of the leaf is called the margin. The margin is distinctive and may serve to assist in separating closely related forms. Examples of leaf margins are shown in figure 20.

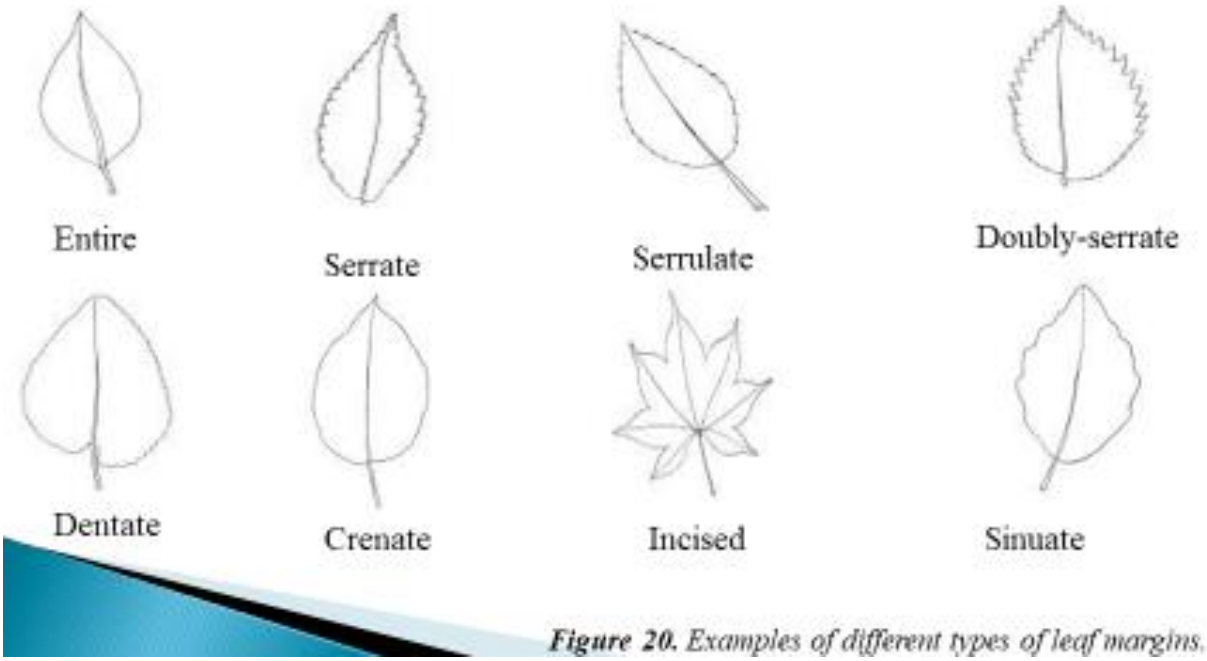

Figure 20. *Examples of different types of leaf margins.*

8- Leaf surface

The surface and texture of the leaf are other means of identification. The hair, resin glands, waxes, blooms, and scales provide valuable clues in naming a tree. The texture of the leaf may feel like leather or like paper.

Lecture 4

B- Twigs and Stem

Twigs are useful in identifying trees except for a short period during the spring when the buds are opening and shoots are elongating on these small branches. Several features of twigs, including buds, leaf scars, lenticels, pith, spurs, thorns, spines, and prickles, can help describe them (table 5 and figure 21). Other factors to consider are color, taste, and odor. The color of the bark can be a most important feature on young stems.

Table 5. Twig characteristics that help with identification

Characteristic	Description
Buds	• Are one location of growth tissue in a tree. • Are usually visible on the twig. • May be either lateral, on the side of the twig, or terminal, at the tip of the twig. • Are scaly or naked, smooth or fuzzy.
Leaf scars	• Are where a leaf falls from the twig. • Vary in size and shape. • Have one or more minute dots or patches that show where the ruptured strands of vascular tissue passed from twig to leaf.
Lenticels	• Are small, normally lens-shaped patches on the stem that facilitate gas exchange. • May be wart-like.
Pith	• Is the central portion of the twig. • Is usually lighter or darker than the wood that surrounds it. • Varies in color. • Is star-shaped or pentagonal in oaks, triangular in alders, terete or cylindrical-like in ash and elms, and chambered in walnuts. • Varies in composition; in most cases is solid, spongy, or hollow.
Spurs	• Are dwarfed twigs with some internodal development. • May grow for several years. • Produce the fruit on many apple varieties
Thorns, spines, and prickles	• Pointed structures that project from the sides of a twig; are important features in some species. • Thorns are modified twigs. • Spines are modified stipules. • Prickles develop from surface tissue and are easily removed.

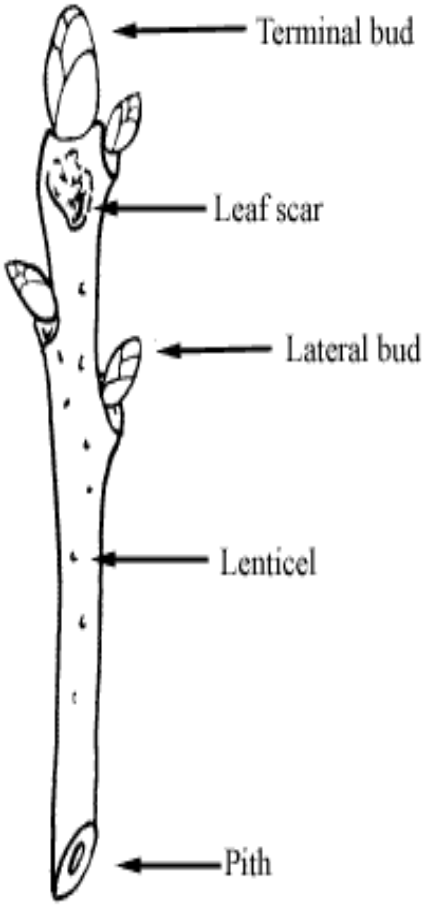

Figure 21. *Characteristic parts of a twig that help in the identification process.*

C- Bark

Bark is one of the most important features for tree identification because of its year-round accessibility. It is especially useful when the tree's leaves and twigs are inaccessible or unavailable during the fall and winter. The shape of the bark is characteristic of some species, for example, the small, rectangular plates on flowering dogwood. Bark on young trees differs from that on more mature trees. Experience is the best way to learn bark characteristics. Table 6 describes bark characteristics that can be used for identifying mature trees. Typical bark textures are illustrated in figure 22.

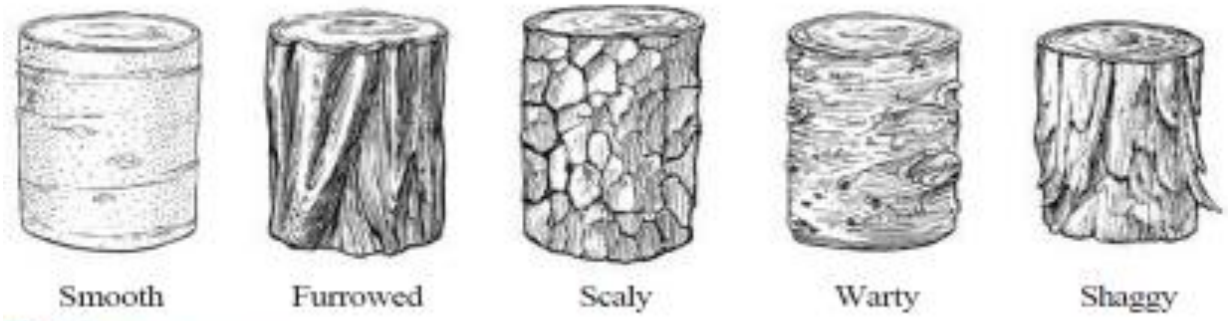

Figure 22. *The differences in bark can be helpful in tree identification.*

Table 6. Bark characteristics that help with identification

Characteristic	Description
Shape or general appearance	The shape of the bark is often characteristic of some species, for example, the small-rectangular plates on the flowering dogwood.
Texture	The feel of the bark, such as the smoothness of cherry trees or the layering or plating of white oaks, is important.
Thickness	The thickness of the bark can vary within a species as well as between species.
Color	Bark color varies with age, location, site, and light conditions.

D- Flowers

Flowers are best feature for identifying trees, but are available only for a short period each year. Leaves, twigs, and bark are usually available for identification, but if there is doubt about a certain tree, the flower is the surest way to identify it. Although not always noticeable to the casual observer, all hardwoods bear flowers. Some produce flowers annually, while others flower less often. Flowers are modified leaves that have undergone change to the point that they have become or support the reproductive organs of the plants.

Complete and incomplete flowers

A complete flower has four parts (figure 23). An incomplete flower is one that lacks any of these four parts.

- Calyx (composed of sepals)
- Corolla (composed of petals)
- Stamens
- Pistils

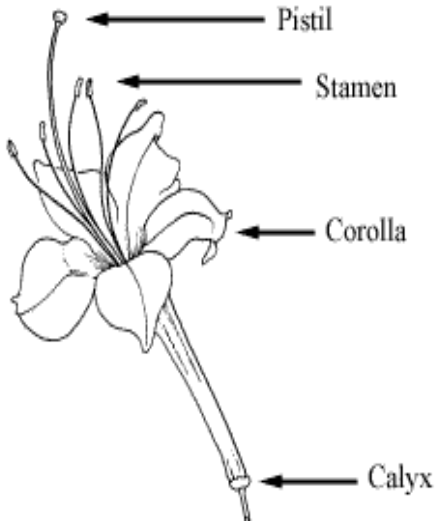

***Figure 23**. A complete flower has all four parts.*

Perfect and imperfect flowers

A perfect flower includes actively functioning organs of both sexes but may lack sepals or petals. The stamen is the male reproductive structure, and the pistil is the female reproductive structure. A perfect flower may be either complete or incomplete. A flower lacking either functional stamens or pistils is imperfect. These flowers may also be known as unisexual flowers, meaning they are either pistilate (female) or staminate (male). These may occur on the same tree, or the male and female parts may be on separate trees, as in the gingko.

Arrangement of flower blooms

Flowers bloom in different arrangements (figure 24).

- Individual or single bloom flowers are typical of many woody plants, for example the magnolia.
- A cluster or an inflorescence is a collection of individual flowers arranged in a specific pattern (Dirr 1990). One that blooms at the end of a central stalk, or rachis, is referred to as a determinate flower. The dogwood tree has a determinate flower. If the flowers open progressively from the base to the apex or from the outside to the center in flat-topped clusters, the flower is indeterminate. The flowering crabapple has an indeterminate flower. A flower at the end of a twig is a terminal flower. An inflorescence that appears in a leaf axil, or bud, is described as axillary. Flowers may also appear from separate flower buds, which are normally located near the tips of the twigs.

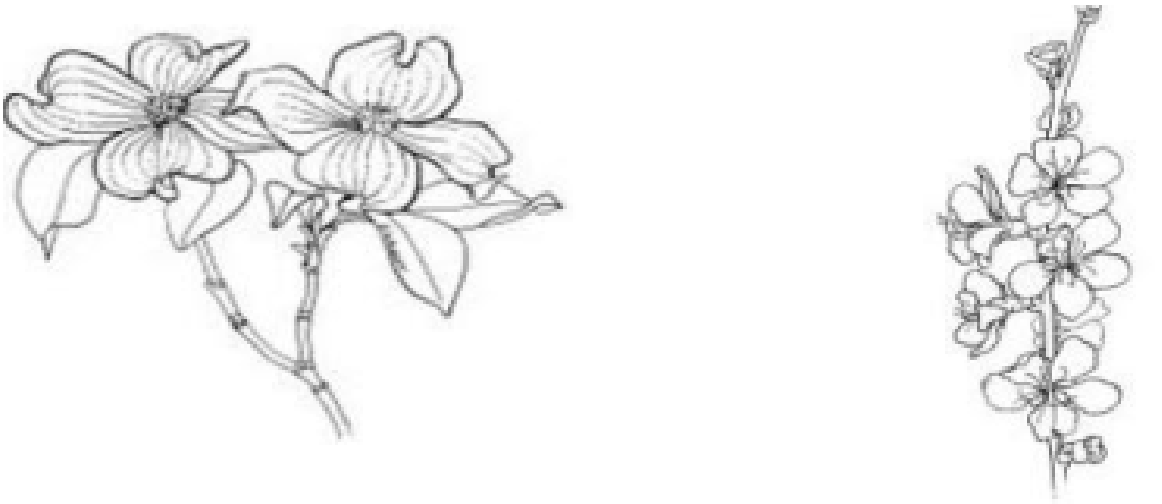

Figure 24. *The characteristic inflorescence of a flower is helpful identification.*

E- Fruits and Seed

Another key to identifying a hardwood is its fruit or seed. A fruit is the seed-bearing organ of the plant. Using fruit is somewhat limited, however, because some trees do not bear fruit and others do so only for a short time or at irregular intervals. Fruits develop from flowers. Solitary flowers that have a single pistil produce a single fruit. A cluster of flowers with multiple pistils produces a cluster of fruit or a compound fruit. Some fruits have only one seed, others develop many seeds. In most species, pollination and fertilization must occur for fruit to develop. Fruit development can take from a week or two in elms to two growing seasons in red oaks. Examples of different types of fruit are shown in figure 25.

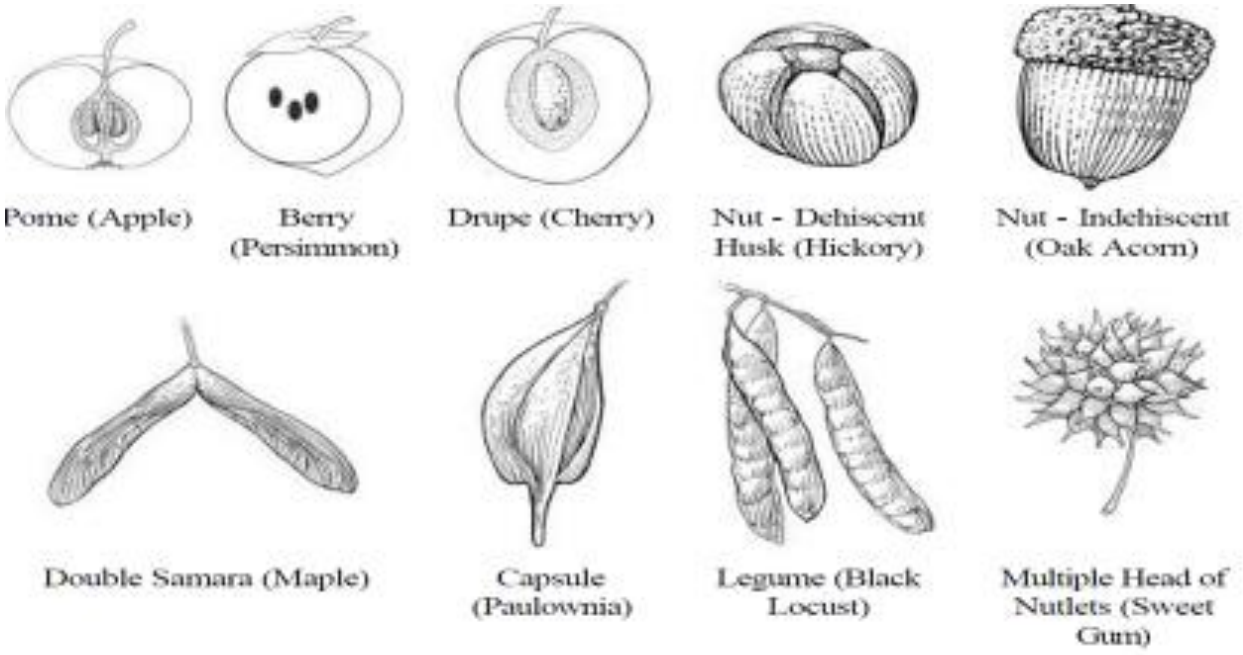

Figure 25. The type of fruit a tree produces can be used in identification.

Seed production and germination depend on many factors, such as temperature extremes, conditions of the tree, and presence or absence of competition. Seed quality, including germination capacity, can vary greatly and is influenced by factors such as the tree's nutrient storage, availability of water, and temperatures and weather conditions.

Simple fruits

Simple fruits develop in various forms. There are two basic types, dry and fleshy, each of which has a wide range of variations.

- The two primary forms of dry fruit are indehiscent, which do not split open at maturity, and dehiscent, which do split open when ripe. Indehiscent fruits are usually one-seeded with the seed enclosed in various types of coverings. Species with this type of fruit include maples and oaks. Dehiscent fruits are usually manyseeded and are enclosed in a covering that splits when the fruit is ripe, such as the redbud, magnolia, and rhododendron.
- Fleshy fruits are usually multi-seeded, the seeds are surrounded by a fleshy pulp, or pericarp, which is sometimes edible. These may be classified as a berry (blueberry and persimmon), drupe (cherry, plum, and holly), or pome (apple or pear).

Compound fruits

Fruits that develop from multiple pistils are called compound. Two types of compound fruit are aggregate and multiple.

- Aggregate fruits develop from a single flower that has many pistils (Dirr 1990) that form many fruitlets in a single mass, such as the magnolia or tulip tree.
- When several flowers together contribute to the development of a single fruit, it is called a multiple fruit (Dirr 1990). The fig tree and the mulberry produce examples of this type of fruit.

F- Cones

Seeds for softwoods (conifers) are found in cones. Most conifers are Monecious. Monecious means that both male and female reproductive parts are located in separate structures on the same tree. A few conifers are dioecious; the male and female reproductive parts are on separate trees. Male and female structures are called cones or stobili (figure 26). Cones consist of an egg or pollen-bearing scales attached to the central stem. The scales may be arranged spirally or they may appear in pairs. Characteristics of three different types of cones are described in table 7.

Table 7. Types of cones

Type of Cone	Description
Pollen cones	• Are generally small, non-woody and short lasting. • Emerge from buds, release pollen, wither and drop within a few weeks. • Bear sacs on the bottom of each scale known as *pollen sacs* or *microsporangia*. • Release thousands of pollen grains when the sacs burst. • Are modifications of shoots, and the scales are modified leaves. • Are found in the mid- to lower crown.
Female cones	• Are larger than male cones. • Are usually woody. • May persist for many years. • Develop to maturity in one or more season and release their seeds in late summer to autumn. • Bear two megasporangia on the top of each scale which contains an ovule. This ovule develops into a seed following pollination and develops an embryo. • Are found in the upper crown of a tree in some species.
Seritinous cones	• These cones are closed tightly with pine tar. Heat from a fire is needed to open the cone. The sand pine and pitch pine have this type of cone.

Tree Form or Shape

Tree form and shape can be useful features for identification. There are two primary tree forms, excurrent and decurrent. Trees that are excurrent, such as conifers, have a dominant trunk with smaller side branches. This form gives the tree a conical or triangular shape. Trees that are decurrent, such as oaks, have spreading branches that give the crown a full, round appearance. A tree may grow differently in various parts of its range so its appearance may vary. A tree that grows large in one part of its range may be shrub-like at the extreme limit of its range.

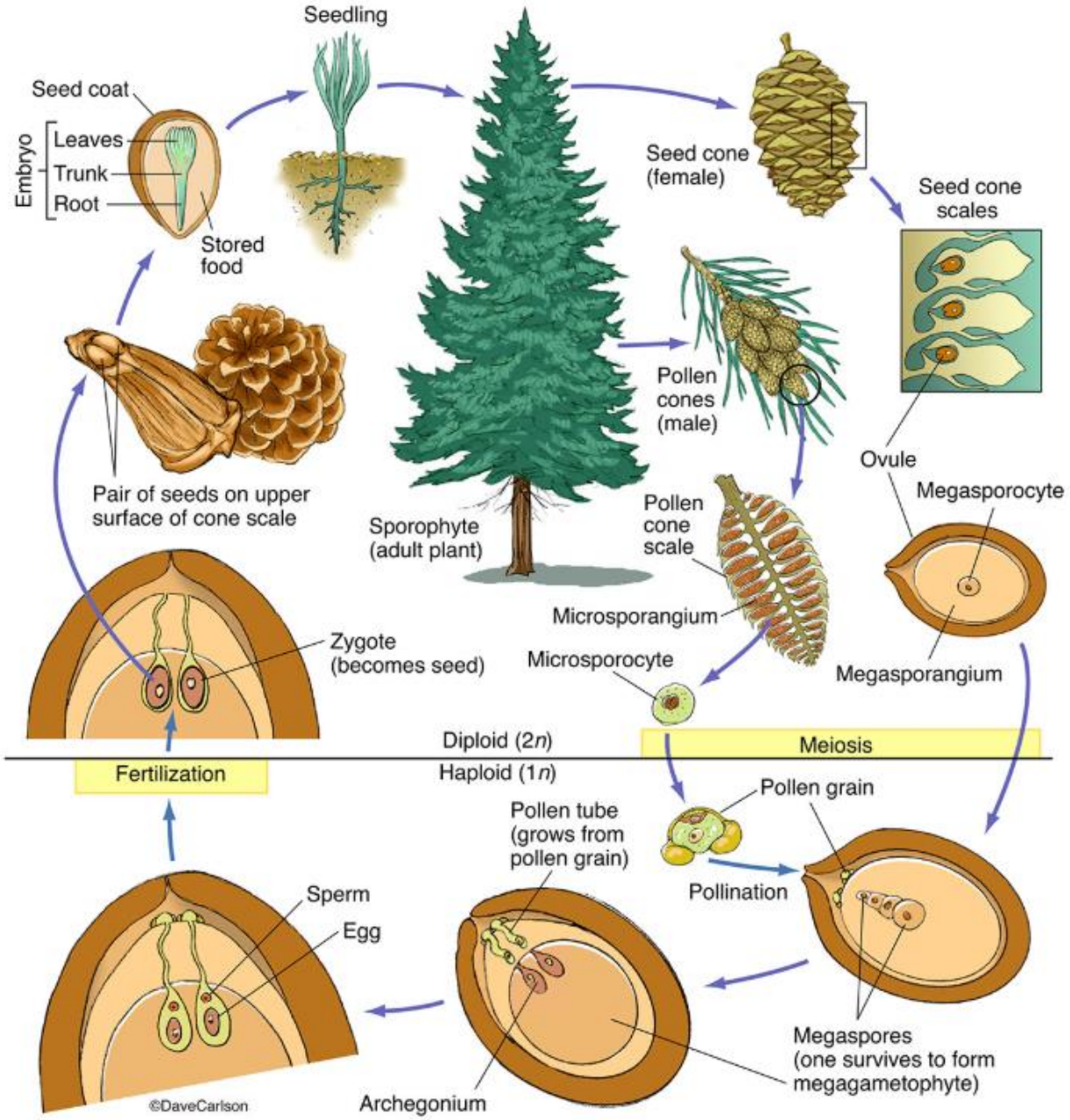

Figure 26. *Seeds are produced on cones in conifers.*