Dendrology

Dendron and Logos, Greek terms for tree and study, were coined in 1668 by Ulisse Aldrovandi. Tree rings identify growth years, age, and orientation, providing insight into past events. Dendrology, a branch of Dendrology, allows the study of geological processes through tree rings, revealing changes in land geology due to external agents like water, wind, and rain and allowing insights into past geological elements and formations.

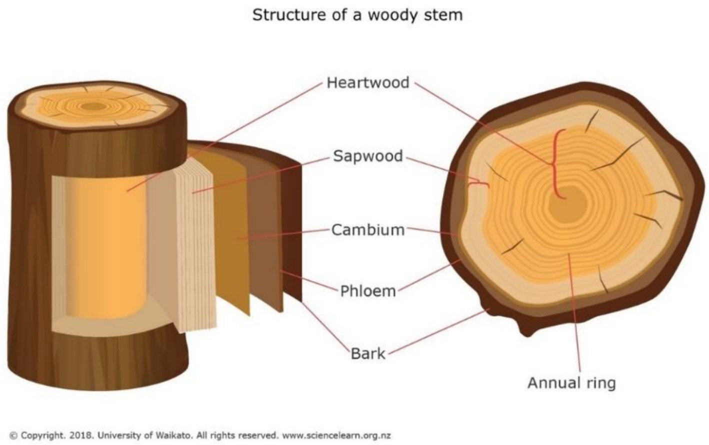
What is dendrology? The term dendrology is derived from two Greek words meaning trees and discourse or study, or the study of trees. A review of the history of usage of the term has been made by William A. Dayton (Dayton 1945). Perhaps the first use of the word was in the year 1668 as the title of a book or encyclopedia on trees by Ulisse Aldrovandi, Italian physician and naturalist. Originally, dendrology included all aspects of trees, and in that time there was no science of forestry. Now, especially in Europe, dendrology also includes shrubs, but in the United States it is still usually restricted to trees.

Dendrology is the study of trees and other woody plants. It involves the identification, classification, and understanding of different tree species, their growth patterns, physiological processes, and interactions with their environment. Dendrologists not only study trees in natural forests but also in urban environments, plantations, and parks. They examine various aspects of trees, such as their morphology (physical characteristics), anatomy, genetics, and ecology. Dendrology plays a crucial role in forest management, conservation, and urban planning by helping to identify and understand tree species, assess their health and condition, and suggest appropriate management strategies.

Or

Dendrology, study of the characteristics of trees, shrubs, lianas, and other woody plants. Dendrology is generally considered to be a branch of systematic botany or forestry and is primarily concerned with the taxonomy of woody species. Historically, dendrology also encompassed the natural history of the woody species in a given area, but such studies are now more properly ascribed to the field of ecology. Modern dendrology is often focused on the identification of economically useful woody plants and their taxonomic relationships for industrial forestry endeavours, though the discipline is also useful for the conservation of rare or endangered species.

Woody plants are usually trees, shrubs, or lianas. These are usually perennial plants whose stems and larger roots are reinforced with wood produced from secondary xylem. The main stem, larger branches, and roots of these plants are usually covered by a layer of bark.



At a basic level, dendrology teaches botanists and foresters the nomenclature and classification of woody plants and how to use morphological characteristics and habitat information to identify unknown species. Major morphological features such as leaves, bark, cones, flowers, fruits, and growth habit are important dendrological identifiers, but more-subtle features, such as buds, twigs, exudates, and leaf scars, are often key factors in distinguishing related species and are particularly useful in the identification of deciduous species in the winter or dry season. Additionally, geographical region, habitat, community composition, and other physical and ecological indicators can provide important identifying information.

Dendrology is the study of trees, including their classification, identification, physiology, and ecology. It involves understanding the different species of trees, their growth and development, their adaptations to various environments, and their interactions with other biotic and abiotic factors.

It is a fairly important source of data for territorial, urban, infrastructure or natural management studies. We must know that for all this type of human actions it is necessary to know the terrain where we are and its evolution. In other words, for developments in urban areas or infrastructures, it may be interesting to know the evolution of the place where it is going to be built. The same happens with the flora and fauna species existing in this same place. The set of all the necessary studies to be able to carry out the construction according to the legal actions is known as an environmental impact assessment. Dendrology has quite a place in these environmental impact studies.

Applied dendrology refers to the practical applications of dendrology in various fields. Some of the main areas where applied dendrology is used include:

1. **Forestry**: Dendrology plays a crucial role in forestry management. It helps in identifying tree species, assessing their growth potential, and determining the appropriate silvicultural practices for plantations or natural forests. Applied dendrology is also used in studying forest ecosystems, predicting forest dynamics, and understanding the impacts of management activities on tree populations.

2. **Arboriculture**: Arboriculture is the management and care of individual trees in urban and suburban settings. Applied dendrology is used to identify and select appropriate tree species for urban areas, evaluate tree health and vitality, diagnose diseases and pests, and prescribe treatment plans. It is also used in pruning techniques and tree risk assessment.

3. **Environmental science:** Dendrology is applied in environmental science to study the impacts of climate change, pollution, and other environmental factors on tree growth and survival. Tree rings, which can be examined through dendrochronology, provide important information about historical climate conditions, as well as the response of trees to environmental stressors.

4. **Wood science and industry**: Applied dendrology is used in the wood industry to identify wood species, assess their properties, determine timber quality and value, and understand wood anatomy. This knowledge is crucial for sustainable timber production, wood products manufacturing, and wood utilization in construction, furniture making, and other industries.

5. **Landscaping and horticulture**: Dendrology is applied in the selection and management of trees in landscapes, gardens, and parks. It helps in identifying suitable species for specific growing conditions, planning tree layouts, and managing the health and aesthetics of trees in designed outdoor spaces.

Overall, applied dendrology has wide-ranging applications in natural resource management, scientific research, and practical tree care, contributing to the sustainable use and conservation of trees and forests.

The history of dendrology can be traced back to ancient civilizations.

1- **Ancient civilizations:** The study of trees can be seen in various ancient civilizations. Greeks, Romans, and Egyptians had a deep appreciation for trees. They recognized their importance for timber, food, medicine, and shade. Ancient Greek philosophers, such as Aristotle and Theophrastus, wrote extensively about different tree species.

2- **Middle Ages**: Dendrology continued to evolve during the Middle Ages. Monks in European monasteries developed extensive gardens where they studied and cultivated different tree species. They also documented their observations and compiled plant encyclopedias known as herbals.

3- **Renaissance and Enlightenment:** The Renaissance period brought a renewed interest in botany and dendrology. Botanical gardens were established during this time, and explorers brought back specimens from around the world, enriching the study of trees. The development of the printing press allowed for the widespread distribution of botanical knowledge.

4- **Modern Dendrology**: The 18th and 19th centuries witnessed a significant advancement in dendrology. Carl Linnaeus, the Swedish botanist, developed a systematic classification system for plants, including trees. In the 19th century, dendrology was further advanced by scientists like George Washington Carver and Charles Sargent. They conducted extensive research on tree species, identified new ones, and contributed to the understanding of their biology and ecological roles.

5- **Modern Developments**: Today, dendrology is a well-established field of study. It has been greatly aided by the advancement of technology, like DNA sequencing, remote sensing, and computer modeling. These tools have helped scientists better understand the genetics, ecology, and conservation of trees.

Dendrology has important practical applications, including forestry, horticulture, ecology, and environmental management. The knowledge gained through dendrology contributes to the sustainable use and conservation of trees and forests.

The Dendrology and relation with other sciences

Dendrology is the scientific study of trees and other woody plants. It involves the identification, classification, and understanding of the anatomy, morphology, physiology, ecology, and taxonomy of trees. Dendrologists, the scientists who study dendrology, often collaborate with other scientific disciplines to gain a comprehensive understanding of trees and their interactions with the environment. Here are some key examples of how dendrology is related to other sciences:

1- **Ecology**: Dendrologists work closely with ecologists to study the ecological interactions between trees and their environment. They analyze tree growth patterns, distribution, and reproduction to understand how trees respond to factors like climate change, competition, disturbances, and symbiotic relationships with other organisms.

2- **Forestry**: Dendrology is closely related to forestry, which is the science and practice of managing forests and tree populations. Dendrologists help in tree species selection, growth prediction, and sustainable management of forests. They identify and assess tree health, study regeneration processes, and contribute to forest conservation and restoration efforts.

3- **Botany:** As a sub-discipline of botany, dendrology focuses specifically on trees and woody plants. Dendrologists study the anatomy, physiology, reproductive biology, genetics, and taxonomy of tree species. This information is crucial for understanding plant evolution, species relationships, and the classification of trees into different groups.

4- **Climatology and Paleoclimatology**: Trees are excellent recorders of climate changes. Dendrologists collaborate with climatologists and paleoclimatologists to analyze tree rings and develop tree-ring chronologies. By studying variations in tree growth rings, dendrologists help reconstruct past climates, track long-term climate trends, and shed light on climatic events such as droughts, storm intensities, and temperature fluctuations.

5- **Geology and Archaeology**: Dendrologists work with geologists and archaeologists to date and interpret tree-ring sequences found in ancient wood samples. This technique, called dendrochronology, helps determine the age of objects made of wood, such as historical artifacts and building materials. It also provides valuable information about past environments, human activities, and natural events.

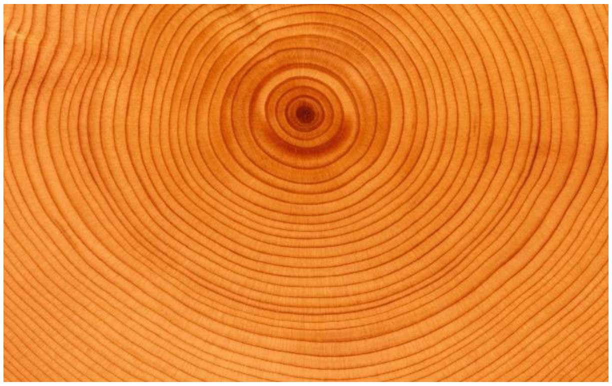
6- **Genetics:** Dendrology involves the study of tree genetics to understand the genetic diversity, gene flow, and population dynamics of tree species. Dendrologists collaborate with geneticists to investigate the genetic basis of traits like wood quality, disease resistance, and adaptation to changing environments. This knowledge aids in tree breeding programs, conservation efforts, and the selection of appropriate tree species for specific environments.

Overall, dendrology has strong interdisciplinary connections with various sciences, enabling a comprehensive understanding of trees and their significance in the natural world.

Dendrology applied to climate:

We know that information on changes in the geology of the terrain is obtained not only from the tree formation rings, but also on the climate. Although most of us know that by counting the tree rings we can know the age of the tree, the truth is that it is not entirely correct. Each tree has a different type of growth than the rest and depends on each species. Not all trees form the same rings very grow in the same way. For this reason, the formation of these rings can also give us information about the prevailing climate at the time when the specific tree has developed.

The dark rings form during the winter time. It is a denser and more compact wood that serves the tree to be able to defend itself against the lower temperatures. Plants must survive harsh environmental conditions in both winter and summer. These are usually two seasons of the year whose environmental conditions are more extreme and, therefore, they need to create mechanisms of defense adaptations. One of them is a thicker wood that is reflected in the darker rings. In this way, lighter rings are generated in summer with a less compact



wood and darker rings with a more compact wood. The clear rings are wider, since the tree enjoys good temperatures and nutrients. In this way, it has a higher plant activity than Allows you to widen the rings longer.

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On some occasions we can find clear rings that are very narrow. This may be a sign of historical droughts. Having no water, the tree cannot grow. In this way, we see that the growth ring is quite narrow but still clear. This is not revealing various types of information. On the one hand, the fact that the ring is clear is not revealing that there have been continuous high temperatures. On the other hand, we are seeing that by not growing and being narrow compared to the other wide clear rings, it indicates that the tree has not enjoyed the nutrients.

Usually the presence of narrower or wider rings is indicating the amount of nutrients available in the medium. If we have a tree with very wide dark rings they reflect long and severe winters. On the other hand, the clear rings are also analyzed for their width. In this way, we can know if the summers have been more or less long and if they have had high or low temperatures.

Climate change and tree rings

Climate change is not only studied by the increase in greenhouse gases and changes in temperature at a global level. It can also be studied through bioindicators known as tree rings. Dendrology is responsible for studying fossil trees that also provide information about the climate of past eras. In this field we know that it is known as dendroclimatology.

We must bear in mind that the study of climate change is essential for the management of natural resources both today and the future. We cannot plan what our economic activities were in the future based on the study of the present. It is necessary to know the different fluctuations that the climate has had throughout the history of the planet. These fluctuations can be known quite well thanks to Dendrology. Tree rings can reflect a great deal of information not only about temperatures and tree growth, but also about the evolution of temperatures and environmental conditions.

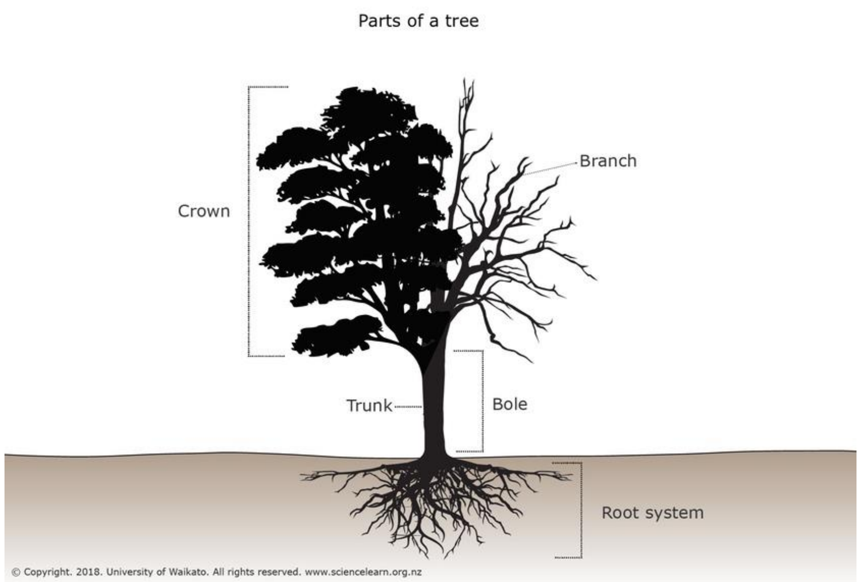
What is a tree?

Trees are plants and carry out the life processes that all plants share. However, trees are not actually a scientific group of their own. Trees may be cone-bearing plants (gymnosperms) or flowering plants (angiosperms). Tree ferns are technically not trees as they do not contain wood.

All the groups of plants that include trees are vascular plants. This means they have vascular tissues called xylem and phloem. Xylem and phloem link all parts of the plant, transporting water, minerals and manufactured food around while also forming part of the structural support for plants.

What makes a plant a tree?

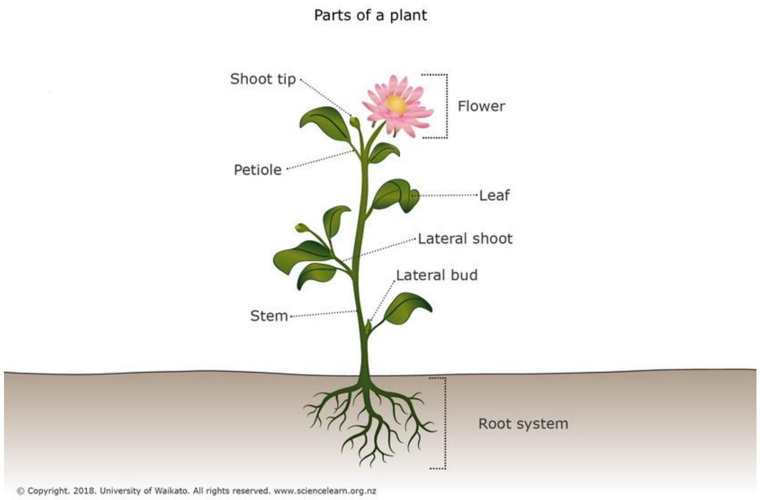
All trees are perennial plants. Many tree varieties live for tens or even hundreds of years, and they tend to live longer than most other types of plants. Trees are also different from many other plants in the following ways: Trees typically have a permanently woody stem or trunk. Most trees grow to a considerable height, usually bearing lateral branches at some distance from the ground.



Shrubs are also woody plants but tend to have several perennial stems and are usually shorter than 4 m. In New Zealand, we don't tend to distinguish too much between trees and woody shrubs. One reason for this is that many of our plants vary considerably in their growth habits depending on the climate they are growing in.

How do plants grow?

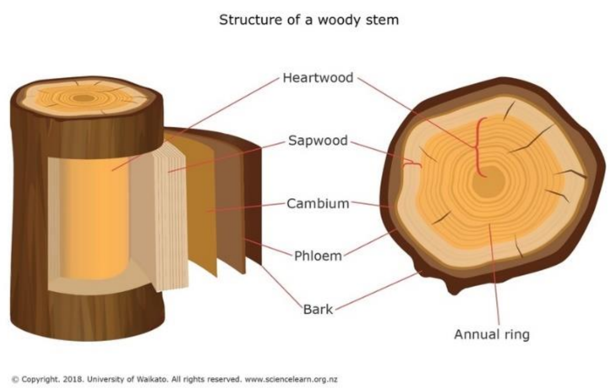
Plants grow bigger because of specialised dividing tissues called meristems. These are found in the shoot tips, root tips and lateral buds and at the tips of any branches or lateral stems. The cells in these meristematic tissues actively divide by mitosis, making the plant grow bigger. This is called primary plant growth. There are also meristematic cells inside the vascular tissues (xylem and phloem) that run up and down inside the plant stems, roots and leaves.



How do trees make wood?

The major reason trees can grow so big is their ability to create woody tissue as they grow. This process is called secondary plant growth. Wood contains a chemical called lignin. Lignin is a component of most plant cell walls, providing rigidity and shape. It is also an important component of vascular tissues and is present in large amounts in all vascular plants, providing structure and support. The hydrophobic properties of lignin also help the xylem transport water.

In woody plants, the vascular bundles grow sideways around the inside of the plant stem and join up as the plant gets older. They become the bands of vascular tissues that you can see in a stem cross-section.



Structure of a woody stem

Each year, the woody stem grows wider due to new xylem and phloem being made by the meristematic tissue. This tissue is called the cambium in a woody stem. Wood is the xylem, and the phloem (outside the cambium) becomes part of the bark. As new phloem is made, the old phloem is pushed out to become bark on the outside of the stem/trunk. As new xylem ages, it becomes increasingly lignified. Eventually, the old xylem stops its job of transporting water and becomes the heartwood of a tree. The active xylem in a tree is also called sapwood. The rings in a tree trunk show the yearly growth of xylem, which, by the time it has become wood, is largely just lignin and cellulose.

Botany

Horticulturists work with a wide array of plants, both as garden friend or foe. This range of different plants brings an enjoyable diversity to the garden and landscape, yet on close observation many similarities become evident. These similarities in basic plant structures and functions, along with the environmental factors that affect plant growth, are the basis of this chapter. The information provided in this chapter will primarily focus on the higher flowering plants because they are most significant in the garden and landscape. This chapter will cover terminology to help enhance your understanding of botanical references in the future and to gain a perspective on the practices discussed in later chapters.

Hundreds of millions of years of evolution have produced an amazingly diverse and complex array of plants. Land plants are primarily divided into two groups: gymnosperms and angiosperms. Angiosperms are flowering plants that produce seeds enclosed in a fruit. There are over 300,000 species of angiosperms distributed all over the world. The gymnosperms, numbering around 700 species, are primarily the evergreen species of the temperate zones. They produce naked seeds, which are usually borne in cones. Gymnosperms generally also have narrow or needle-like leaves, while angiosperms usually have broad leaves.

Angiosperms are first subdivided into two major subclasses based on their vascular (or vein) arrangement. The dicots include most of the broadleaf herbs, shrubs, and trees. Monocots include such orders as lilies, palms, and grasses.

Plant Cell Structure and Function

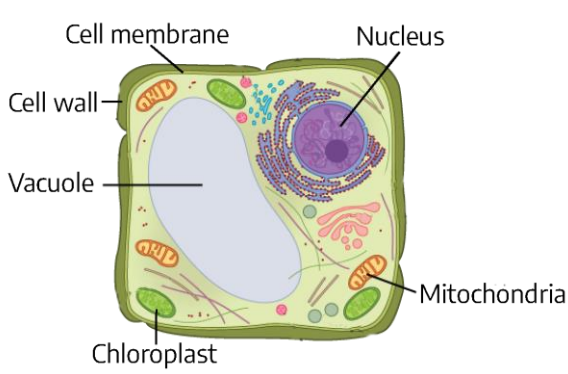


Figure 1-1: Plant cell diagram: This plant cell is surrounded by a rigid cell wall and then a cell membrane. It contains important organelles including the vacuole (storage cavity), chloroplast (responsible for photosynthesis), mitochondria (responsible for respiration), and nucleus (contains genetic material).

Cells are the structural and functional units of life. Large organisms are made up of trillions of cells, while small organisms may be composed of only a single cell. Both plants and animals are made of cells, though plant and animal cells are somewhat different.

Plant cells consist of a cell wall containing cellulose, a chemical compound. Inside the cell wall, a plant cell has some of the same features as animal cells: a cell membrane, mitochondria (which are responsible for respiration, or energy production), a nucleus (which contains the genetic information for the organism and controls the activities of the cell), and numerous other organelles necessary to carry out the mechanisms of life. Plant cells also develop one (or more) large liquid-filled cavity called a vacuole.

Plant cells have special structures called chloroplasts. Chloroplasts are the sites of photosynthesis and contain chlorophylls and carotenoid pigments. Chlorophyll is responsible for the green color of plants. Carotenoids are yellow and orange pigments that are masked by the more numerous chlorophyll pigments in green leaves. Chloroplasts are found only in plants and green algae (Evert and Eichhorn, 2012).

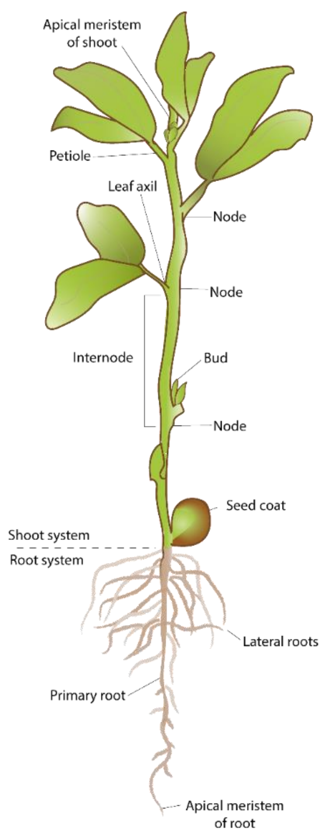


Figure 1-2: A few principal parts of a vascular plant include the stem, buds, leaves, and root system. The apical meristem of the root/shoot is the site of cell division that makes the plant elongate. Plant cells grow and divide in different directions, creating all the structures of the plant like roots, stems, leaves, and more.

Anatomy: Plant Parts and Functions

Stem Anatomy

Stems are structures that support buds and leaves and serve as conduits for water, minerals, and sugars. The three major internal parts of a stem are the xylem, phloem, and cambium. The xylem and phloem are the major components of a plant's vascular system. The vascular system transports food, water, and minerals and offers support for the plant. Xylem tubes conduct water and minerals to the leaves, while phloem tubes conduct sugars and other metabolic products away from the leaves.

The xylem and phloem make up the vascular system of the stem and are arranged in distinct strands called vascular bundles that run the length of the stem. When viewed in cross section, the vascular bundles of dicot stems are arranged in a ring. In plants with stems that live for more than one year, these individual bundles grow together (producing growth rings). In monocot stems, the vascular bundles are randomly scattered throughout the stem.

The difference in the vascular system of the two groups is of practical interest to the horticulturist because certain herbicides are specific to either monocots or dicots. An example is 2,4-D, an herbicide that only kills dicots. In contrast, dicots may be more readily grafted as it is easier to align the vascular rings of the two stem pieces compared to the scattered bundles in monocots.

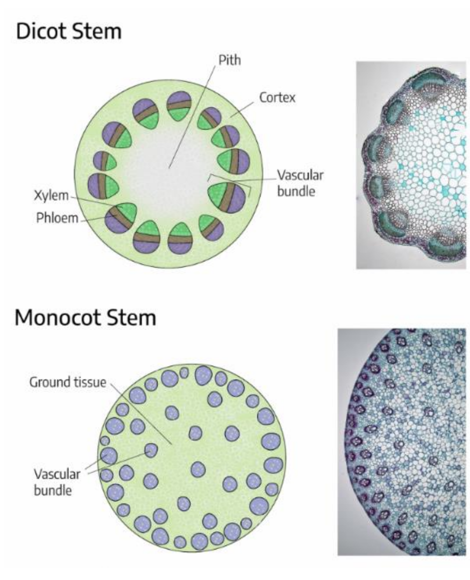


Figure 1-3: Stem drawing: Illustrates the difference between a typical dicot and monocot stem. In the dicot stem, xylem and phloem are arranged into vascular bundles which are arranged circularly around the perimeter of the stem. Vascular bundles in the monocot stem are arranged randomly.

A part of the stem where a bud is located is called a node. This is where leaves are attached to the stem, and buds are located in these leaf axils (angle between stem and bud/leaf).

The stem section between nodes is called the internode. The length of an internode may depend on many factors. Internode length varies with the season. Growth produced early in the season has the greatest internode length; length decreases as the growing season nears its end. Decreasing fertility will decrease internode length. Too little light will result in a long internode, causing a spindly stem. This situation is known as stretch or etiolation. Vigorously growing plants tend to have greater internode lengths than less vigorous plants. Internode length will also vary with competition from surrounding stems or developing fruit. If the energy for a stem has to be divided among three or four stems, or if the energy is diverted into fruit growth, internode length will be shortened.

A bud is a small package of partially preformed tissue which becomes leaves/stems or flowers. In some cases, buds contain partially preformed flower tissue (flower bud), and usually have a different appearance from a vegetative bud, a bud that contains partially preformed leaf and stem tissue. Some buds contain both floral and vegetative tissues.

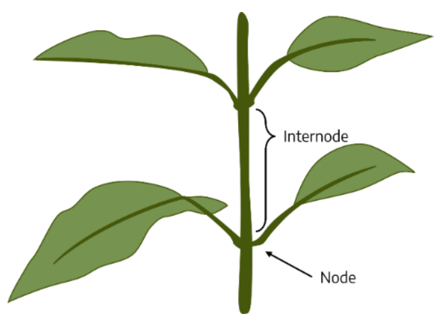


Figure 1-4: Stem nodes are where leaves or buds grow from. The space between nodes is called the internode.

Modified stems

The presence of leaves (regular or modified) or buds distinguishes a stem. Although typical stems are above-ground trunks and branches with great distances between leaves and buds, there are modified stems that can be found above ground and below ground. The above-ground modified stems are crowns, stolons, and spurs; and the below-ground stems are bulbs, corms, rhizomes, and tubers.

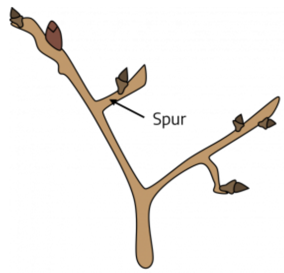


Figure 1-5: Spurs are short side stems.

Above-ground stems

Spurs are short, stubby, side stems that arise from the main stem. They are common on such fruit trees as pears, apples, and cherries, and are capable of bearing fruit. If severe pruning is done close to fruit-bearing spurs, the spurs can revert to a long, nonfruiting stem.

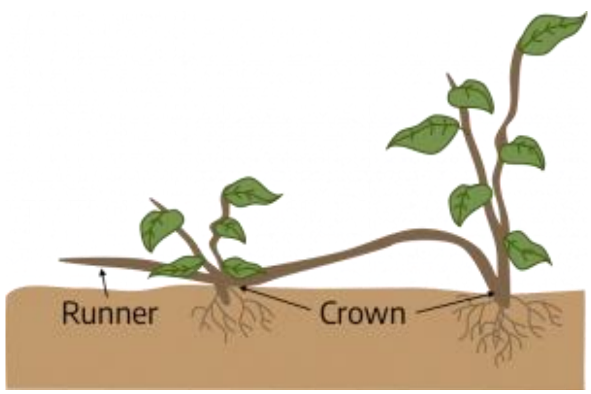


Figure 1-6: Diagram of a crown (region of compressed stem tissue from which new shoots are produced) and runner (type of stolon that grows on soil surface).

Crowns (seen in strawberries, dandelions, and African violets) are another type of compressed stem having leaves and flowers on short internodes. A crown is a region of compressed stem tissue from which new shoots are produced, generally found near the surface of the soil. Crowns are located at soil level so that roots support them upright and the central growing point is never covered with soil. Many herbaceous perennials, such as Shasta daisy, also develop crowns that enlarge with branching over successive years. These crowns persist over winter with buds that develop into elongated aerial stems during the growing season. A stolon is a horizontal stem that is fleshy or semi-woody and lies along the top of the ground. The spider plant has stolons. A runner is a type of stolon. It is a specialized stem that grows on the soil surface and forms a new plant at one or more of its nodes.

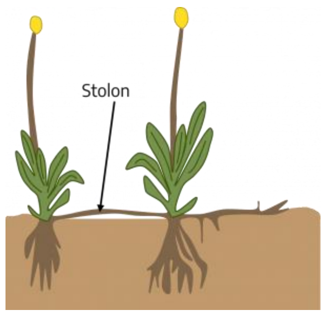


Figure 1-7: Stolon (horizontal stem that lies along the top of the ground).

Strawberry runners are examples of stolons. Remember, all stems have nodes and buds or leaves. The leaves on strawberry runners are small, but are located at the nodes, which are easy to see. The nodes on the runner are the points where roots begin to form.

Below-ground stems, such as the potato tuber, the tulip bulb, gladiolus corm, and the iris rhizome, store food for the plant.

Below-ground stems

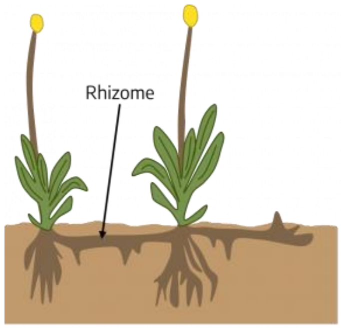


Figure 1-8: Rhizome (horizontal stem that grows underground).

Rhizomes are similar to stolons but grow underground. Some rhizomes are compressed and fleshy, such as those of iris; they can also be slender with elongated internodes, such as bentgrass. Bermudagrass is both an effective lawn grass and a hated weed principally because of the spreading capability of its rhizomes.

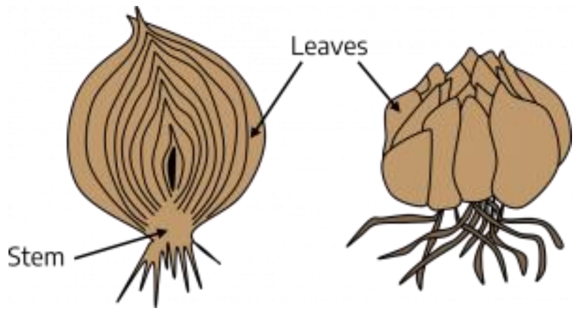


Figure 1-9: Bulb (shortened, compressed underground stems surrounded by fleshy scales).

Tulips, lilies, daffodils, and onions are plants that produce bulbs — shortened, compressed, underground stems surrounded by fleshy scales (leaves) that envelop a central bud located at the tip of the stem. If you cut through the center of a tulip or daffodil bulb, you can see major plant parts within the bulb. Many bulbs require a period of low-temperature exposure before they begin to send up the new shoot. Both the temperature and length of this treatment are of critical importance to commercial growers who force bulbs for holidays.

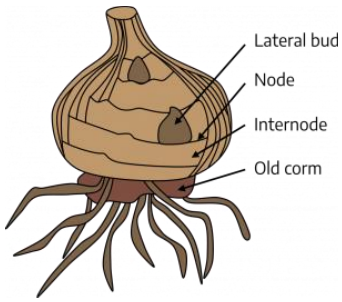


Figure 1-10: Corm (solid, swollen stem with dry leaf-like scales).

Corms are not the same as bulbs. They have shapes similar to bulbs, but do not contain fleshy scales. A corm is a solid, swollen stem whose scales have been reduced to a dry, leaf-like covering. Examples of corms include gladiolus and crocus.
A **tuber** is an enlarged portion of an underground stem. The tuber, like any other stem, has nodes that produce buds. The eyes of a potato are actually the nodes on the stem. Each eye contains a cluster of buds.

Figure: 1-11: Tuberous begonia stem with leaves growing from the crown.

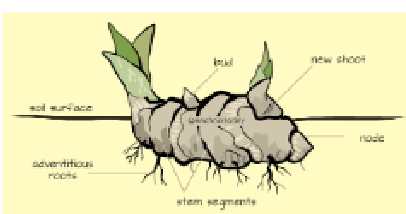
Some plants produce a modified stem referred to as a tuberous stem. Examples are tuberous begonia and cyclamen. The stem is shortened, flattened, enlarged, and underground. Buds and shoots arise from the crown, and fibrous roots are found on the bottom of the tuberous stem.

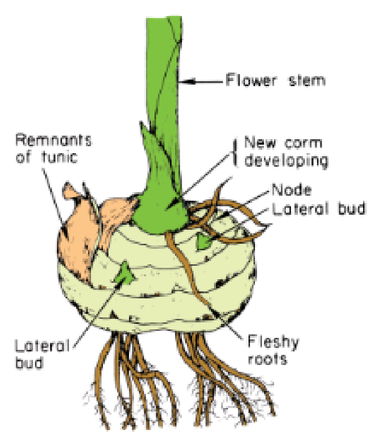
In addition, some plants, such as dahlia and sweet potato, produce an underground storage organ called a tuberous root, which is often confused with a bulb or tuber. However, these are roots, not stems, and have neither nodes nor internodes.

Figure 1-12: Tuberous dahlia root.

It may sometimes be difficult to distinguish between roots and stems, but one sure way is to look for the presence of nodes with their leaves and buds. Stems have nodes; roots do not.

Rhizome	Corm
1. It is a prostrate, thickened underground stem	1. This is a stout, solid, fleshy underground stem growing vertically.
2. It is usually branched and rarely unbranched.	2. It is usually unbranched.
3. It is elongated in shape.	3. It is spherical in shape.
4. It contains a less amount of food material.	4. It contains a heavy deposit of food material
5. They are generally perennial and live for several years.	5. They can leave only for few (1-3) years.
6. Growth is continuous so that succession of rhizome is not produced.	6. New corm is produced every year in the above or on the side of old corm.
7. Examples ginger, water lily,	7. Examples: *Colocasia*, *Crocus*.





Types of stems

A **shoot** is a young stem with leaves present. A twig is a stem that is less than one year old and has no leaves since it is still in the winter-dormant stage. A branch is a stem that is more than one year old and typically has lateral stems. A trunk is a main stem of a woody plant. Most trees have a single trunk.

Trees are perennial woody plants, usually with one main trunk and usually more than 12 feet tall at maturity.

Shrubs are perennial woody plants that have one or several main stems, and usually are less than 12 feet tall at maturity. The distinction between a small tree and large shrub is blurry, and often botanists will describe these plants as small trees or large shrubs.

A **vine** is a plant that develops long, trailing stems that grow along the ground unless they are supported by another plant or structure. Some twining vines circle their support clockwise (hops or honeysuckle), while others circle counter-clockwise (e.g., pole beans or Dutchman's pipe vine). Clinging vines are supported by aerial roots (e.g.,English ivy or poison ivy). A tendril is a modified plant part (leaf, stem, or flower, depending on the plant) that encircles the supporting object (e.g., cucumber, gourds, grapes, and passionflowers). Some tendrils have adhesive tips (e.g., Virginia creeper and Japanese creeper).

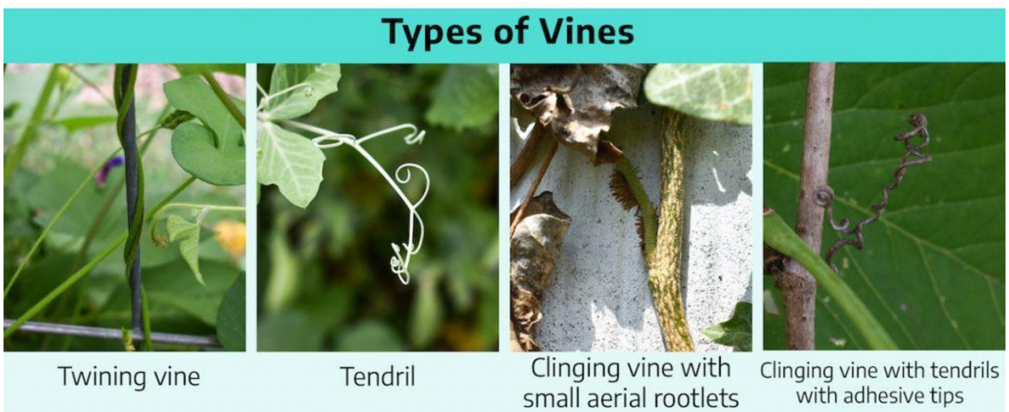


Figure 1-13: Types of vines include twining vines, tendrils, clinging vines with aerial rootlets, and clinging vines with tendrils that have adhesive tips.

Texture and growth of stems

Woody stems contain relatively large amounts of hardened xylem tissue in the central core and are typical of most fruit trees, ornamental trees, and shrubs. A cane is a stem that has a relatively large pith (the central, strength-giving tissue of stem) and usually lives only one or two years. Examples of plants with canes include rose, grape, blackberry, and raspberry. Herbaceous or succulent stems contain only small amounts of xylem tissue and usually live for only one growing season. If the plant is perennial, it will develop new shoots from a crown or underground part. An example of a plant with herbaceous stems is mayapple (Podophyllum peltatum), a native perennial that grows back each year from underground roots.

The edible portion of cultivated plants such as asparagus and kohlrabi is an enlarged succulent stem. The edible parts of broccoli are composed of stem tissue, flower buds, and a few small leaves. The edible part of potato is a fleshy, underground tuber. Although the name suggests otherwise, the edible part of the cauliflower is immature inflorescence (flowers) and flower stalk.