Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Tree Laws

Version 5.1

There are four Maryland tree laws that the Licensed Tree Expert may come across. These are:

- Tree Expert Law
- Roadside Tree Law
- Reforestation Law
- Forest Conservation Law

The **Maryland Tree Expert Law** was adopted in 1945, providing a state-wide law addressing tree care work done for compensation on private or public property in Maryland. The purpose is to provide a layer of consumer protection by licensing qualified and insured tree care companies and individuals. All tree care professionals practicing in Maryland must obtain a Tree Expert license. This license must be renewed every two years.

Every licensee must carry and show proof of liability and property damage insurance. The LTE must maintain insurance protection for the period the license is in effect and also be in compliance with the requirements of Worker's Compensation.

The Tree Expert Law states that a person may not engage in the work or business of a tree expert without a Tree Expert license. It further states that a person may not solicit, advertise, or represent themselves to the public as a tree expert, or assume to practice as a tree expert, or use the title or abbreviation "L.T.E." of any other words, letters, or abbreviations tending to indicate that they are a licensed tree expert or a tree expert without having received a license, or when the license has been revoked or suspended. A criminal conviction for a first offence under the Tree Expert Law is a misdemeanor and is subject to a fine up to $500.

A *tree expert* is someone who represents to the public that they are skilled in the science of tree care or removal and who, whether in the business of the person or as an employee of another person and whether under the title of arborist, tree specialist, tree surgeon, tree expert, or otherwise, engages in the business or work of treatment, care, or removal of trees for compensation. Treatment and care of trees includes:

- Making diagnoses;
- Prescribing the treatment of trees;
- Supervising the treatment of trees;
- Tree trimming, pruning, thinning, cabling, shaping, or crown reduction.
- Tree Removal.

Tree Expert does not include a person engaged in commercial logging or timber harvesting, a person engaged in the installation of underground facilities or any associated site construction, a person who treats, cares for, or removes a tree that is 20 feet tall or less.

The Department of Natural Resources Forest Service shall issue a "tree expert" license to any applicant who:

- pays the fee;
- has attained 18 years of age; and
- has had 2 years of approved college education in forestry, arboriculture, horticulture, applied agricultural sciences, or the equivalent education and 1 year of experience with a licensed tree expert in Maryland or with an acceptable tree expert company in another state and has passed the examination given by the Department; or
- for at least 3 years immediately preceding the date of his/her application has been engaged continuously in practice as a tree expert with a licensed tree expert in Maryland or with an acceptable tree expert company in another state; and
- has passed the tree expert exam given by the Department.

The Department may issue a license to someone that holds a tree expert license in another state provided that the requirements in that state are, in the opinion of the Department, at least equivalent to those in Maryland.

The Department may permanently revoke or temporarily suspend the license of any Licensed Tree Expert (LTE) who is found guilty of any fraud or deceit in obtaining the license, or negligence or wrongful conduct in the practice of tree culture or care. It is a criminal offense to continue to practice as a Tree Expert while the license is under suspension or revocation. A license may not be revoked or suspended until after the licensee has a hearing before the department.

A Licensed Tree Expert is responsible for the quality and content of all work performed by those working under the license. An employee working under the supervision of a LTE may not be required to have a license of their own.

If the owner of a tree employs an unlicensed person to trim a tree in Maryland, the owner is not guilty under the Tree Expert Law. The responsibility is on the person who is doing the tree work.

The Tree Expert Law Regulations

The following are the regulations for the Licensed Tree Experts as found in the Code of Maryland Regulations (COMAR). Title 08, Subtitle 07, Chapter 07.

1) Responsibility to the Public:

A) A LTE shall comply with applicable laws and regulations pertaining to tree expert services;

B) A LTE may not engage in any form of false or misleading advertising or promotional activities, including, but not limited to, the falsification or misrepresentation of:
(1) the work of a LTE or anyone employed by the LTE,
(2) the academic or professional qualifications of the LTE,
(3) the expertise or licensing status of the LTE.

C) A LTE may not use private property adjacent to a client's property as a work area, or gain access to the client's property, without the property owner's permission.

D) A LTE shall ensure the safe operation of all equipment used in the performance of tree expert services.

E) In the performance of tree expert services, a LTE shall make every reasonable effort to protect the safety, health, property, and welfare of the public.

F) A LTE shall cooperate fully with DNR Forest Service in an investigation or adjudication of an alleged violation of tree expert statutes or regulations.

G) A LTE shall, within a reasonable time, inform the DNR Forest Service in writing of a change in address, telephone number, or employment.

2) Incorporation by Reference:

A) The following documents are incorporated by reference into the LTE regulations:
(1) ANSI A300 (Part 1) – 2008 Pruning;
(2) ANSI A300 (Part 2) – 2011 Fertilization;
(3) ANSI A300 (Part 3) – 2013 Standard Systems a. Cabling, Bracing, and Guying);
(4) ANSI Z133.1 – 2012 Safety Standards.
(5) ANSI A300 (Part 4) – 2014 Lightning Protection Systems;
(6) ANSI A300 (Part 5) – 2012 Management of Trees & Shrubs;
(7) ANSI A300 (Part 6) – 2012 Transplanting;
(8) ANSI A300 (Part 7) – 2012 Integrated Vegetation Management a. (9) Electric Utility Rights-of-way.
(9) ANSI A300 (Part 9) – 2011 Tree Risk Assessment.

3) Responsibility to the Client:

A) A LTE shall perform tree expert services only if qualified to do so by education or experience;

B) A LTE shall act with reasonable care and competence, and shall apply technical knowledge and skills according to American National Standards Institute published tree care standards as incorporated by reference in Regulation .02 above;

C) A LTE may not knowingly assume or accept any position in which the LTE's interests conflict with the licensee's professional responsibilities unless the facts are disclosed by the licensee and consented to in writing by the client or employer;

D) The LTE shall enter into a written contract with the client which shall clearly convey the:

(1) LTE's name, license number, name of licensee's business entity, address, and phone number;
(2) Name, address, and phone number of the client;
(3) Objective and scope of services;
(4) Anticipated dates of the LTE's work on the project;
(5) Implications of any deviation from ANSI standards;
(6) Amount and method of remuneration for the services;
(7) Dated signatures of LTE or LTE's designee and the client or the client's designee.

E) Any amendments to the contract shall be in writing and signed and dated by both the LTE or designee and the client or designee;
F) A LTE may not accept compensation from more than one employer for the same service unless all parties involved are informed and consent;
G) A LTE may not exploit clients served professionally by:

(1) accepting a tree care project if benefit cannot reasonably be expected to accrue to the tree or trees or to the client;
(2) continuing treatment when benefit cannot reasonably be expected to accrue to the tree or trees or to the client;
(3) charging for services not rendered;
(4) failing to fully inform clients served of the nature and possible effects of services rendered;
(5) misrepresenting services rendered.

H) A LTE who anticipates the termination or interruption of service during the term of a contract shall notify the client promptly.

4) Responsibility to Other LTEs and the Profession:

A) A LTE shall pursue all professional endeavors with honesty, integrity, fairness, and professionalism;
B) A LTE may only take credit for services performed by the LTE directly or the LTE's firm under the LTE's supervision;
C) A LTE shall adhere to and maintain standards of professional conduct that reflect in a responsible manner on the profession.
D) A licensed tree expert shall disclose associations with multiple tree care companies to each tree care company for which the licensee provides tree care services or supervision of tree care services.

5) Record Keeping:

A) A LTE shall maintain records for 3 years after project completion;
B) If requested, the LTE shall release a copy of written record to any current of former client.

6) Supervision:

A LTE is responsible for the quality and content of all work performed by those working under the license.

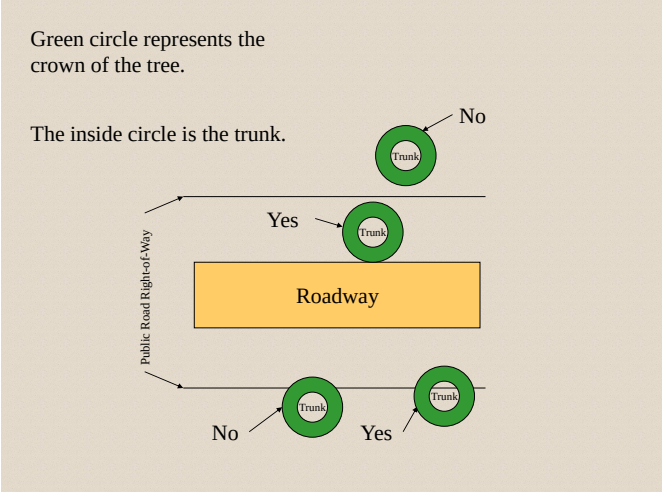
7) Violation of Regulations:

A) The Department of Natural Resources may temporarily suspend, for a period not to exceed 2 years, the license of a licensed tree expert who violates this regulation. This is in addition to, and not in limitation of, the DNR's power to revoke or suspend a tree expert license.

B) Before the suspension, revocation, or denial of a tree expert license, DNR shall provide a contested case hearing.

The **Maryland Roadside Tree Law** was passed in 1914 to protect Maryland's roadside trees by ensuring their proper care and protection and ensuring their compatibility with an efficient and dependable public utility system.

Before a roadside tree is trimmed or cared for in any way, including the application of pesticides, a Tree Care Permit must be obtained from the Maryland DNR Forest Service. A *roadside tree* is any plant with a woody stem that grows all, or in part, within a public road right-of-way.



A permit is also needed to plant a tree within the public road right-of-way. When tree care is performed on a roadside tree without a permit, a fine may be assessed or more severe actions taken by the Department of Natural Resources.

Permits are a good tool to protect our roadside trees. Issuance of Tree Care Permits is important to insure:

- Only beneficial and necessary tree trimming, root cutting, fertilization, or other maintenance practices will be done and done correctly to roadside trees.
- Tree hazards are documented and corrective action, including removal and replacement, is done in a timely and safe manner by trained professionals (Licensed Tree Experts or Roadside Tree Care Experts).

- The right tree (correct species and size) is planted in the right location, thereby avoiding future problems and conflicts with sidewalks, overhead and underground utilities, and sight distances.

The permit procedure requires that the property owner who has a roadside tree (within the public road right-of-way) in front of his/her property signs the application. If the roadside tree straddles two properties, both owners must sign the same application. The permit itself does not grant permission to do the tree work. Permission must be granted by the tree owner.

Maryland has adopted the so-called Massachusetts Rule that limits a landowner's remedy against encroaching vegetation to "self-help" in nearly all circumstances. A landowner must assume responsibility for the care and preservation of his/her own property. Under the "self-help" rule, a neighbor can cut back encroaching limbs or roots of an adjoining neighbor's tree to the property line, but they:

- May not destroy the tree by the pruning;
- May not cut down the tree itself;
- Must stop at the property line, unless they have the neighbor's permission to cross.

Any person who trespasses and removes trees, unless they work for a public service company or a public road agency, is liable for any surveys or appraisals needed, any court costs that may incurred, and triple the amount of the value of the trees or timber cut.

Under Maryland law, a "trespasser" is a person who intentionally and without consent or privilege enters another's property. Action for trespass to real property may be maintained whether or not the person was aware that they were trespassing.

Tree Care under the Roadside Tree Law is defined as the removal of a roadside tree, planting or maintenance, or both, of a roadside tree, application of pesticide to a roadside tree, or treatment that may affect the health or growth of a roadside tree. When trees are removed from the right-of-way, replacement of those trees may be required by the Forest Service.

Any work, including removal, performed on a roadside tree must be done by a Licensed Tree Expert (LTE) or Roadside Tree Care Expert (RSCTE), or someone working under the supervision of LTE or RSCTE. A permit is also needed to plant a tree within the public road right-of-way.

A person may cut down or prune a roadside tree without a permit only if the tree is uprooted or broken and in contact with an electric line, its branches are in immediate danger to persons or property, or stands within the right-of-way of a dedicated but unimproved road.

Branches to be removed shall be cut back to a live lateral at least 1/3 the diameter of the severed branch. Cuts shall be made sufficiently close to the trunk or parent limb without cutting into the branch collar or leaving a protruding stub. Proper pruning techniques shall be followed at all times. The State of Maryland requires all Licensed Tree Experts to follow ANSI A300 (Part 1) pruning standards.

Except when directed by the Forest Service, pruning cuts shall be left unpainted for aesthetic reasons. If the painting of cuts is required, only materials nontoxic to the cambium layer shall be used.

Dangerous deadwood and broken limbs which are located within the scope of the work as defined in the permit shall be removed.

Except when authorized by the Forest Service or when the tree is being removed, climbing hooks or spurs are prohibited. The wrapping or winding of cable, wires, and other attachments around a tree, fastening attachments to a tree to bruise or injure a tree, or cavity work performed on a tree, is prohibited.

Chips resulting from roadside trees may be broadcast on a right-of-way except in ditches, waterways, turf, and surfaced areas; and, may not exceed 6 inches in depth on the right-of-way.

Persons clearing for utility wires, cables, or other facilities shall allow sufficient clearance for two years growth normally expected after trimming, take into account the health of the tree, and make proper cuts to direct growth away from the lines.

The critical root zone of a tree should be protected during tree care operations. The State Forest Conservation Manual defines the critical root zone as a circle with a radius of 1.5 feet for every 1 inch diameter of the tree at breast height (4.5 feet above ground - dbh). When root pruning or cutting trenches around roadside trees, the maximum diameter root that may be cut without approval of the Forest Service is one inch.

Damage sustained by a tree, such as broken limbs, roots, or scarred trunks, including compaction damage, shall be repaired by the permittee. If a trimmed tree dies within one year or is in poor condition of growth as a result of trimming, the Forest Service may require the permittee to remove and replace the trees.

Roadside Tree Blanket permits are issued for comprehensive and continuing programs of general tree care such as those administered by state agencies, counties, municipalities, corporations, and public utilities. Applications are available at the forest service web site.

Roadside Tree Project permits are issued for a specific tree or group of trees for specific tree care operations. This is the permit form to use if you do not have a Roadside Tree Blanket permit, or if your Roadside Tree Blanket permit does not authorize the desired work. Roadside Tree project permits are located at the forest service web site.

Roadside Tree Care Standards.

A. General Requirements. Unless the Forest Service grants an exception, treatment of roadside trees authorized by permit shall be performed according to the following standards:

(1) Branches to be removed shall be cut back to a live lateral branch at least 1/3 the diameter of the severed branch;

(2) Cuts shall be made sufficiently close to the trunk or parent limb without cutting into the branch collar or leaving a protruding stub;
(3) Proper pruning techniques shall be followed at all times;
(4) Except when directed by the Forest Service, pruning cuts shall be left unpainted for aesthetic reasons;
(5) If the painting of cuts is required, only materials nontoxic to the cambial layer shall be used;
(6) Dangerous deadwood and broken limbs which are located within the scope of the work as defined in the permit shall be removed;
(7) Except when authorized by the Forest Service or when the tree is being removed, climbing hooks or spurs are prohibited;
(8) Chips resulting from roadside tree care may:
(a) Be broadcast on a right-of-way except in ditches, waterways, turf, and surfaced areas, and
(b) Not exceed 6 inches in depth on the right-of-way;
(9) The wrapping or winding of cable, wires, and other attachments around a tree, fastening attachments to a tree to bruise or injure a tree, or cavity work performed on a tree, is prohibited; and
(10) When trees are removed, replacement of those trees according to a plan may be required by the Forest Service.

B. Tree Clearance for Overhead Facilities.
(1) In addition to the requirements of §A of this regulation, a person who trims a tree to provide clearance for utility wires, cables, or other facilities shall:
(a) Allow sufficient clearance for 2 years growth normally expected after trimming, unless otherwise directed by the Forest Service;
(b) Take into account the health of the tree; and
(c) Make proper cuts that direct growth away from overhead wires and facilities in compliance with safety standards and government regulations.
(2) If a trimmed tree dies within 1 year or is in poor condition of growth as a result of that trimming, the permittee shall, if required by the Forest Service, remove the tree and plant replacement trees.
(3) Replacement trees shall be:
(a) Furnished by the permittee;
(b) In good condition;
(c) Of a recommended size and species; and
(d) Properly planted at locations to be determined by the Forest Service.

C. Ground Disturbance Requirements.
(1) The requirements set forth in this section:
(a) Are intended to protect roadside trees during construction, installation, and maintenance of a structure requiring excavation;
(b) Apply to underground utilities such as:
(i) Sewers,
(ii) Water and gas pipes,
(iii) Storm drains,

(iv) Electric, telephone, and television cables or conduits,
(v) Sidewalks,
(vi) Driveways, or
(vii) Roadways or similar structures.

(2) A permittee shall take all necessary measures to protect roadside trees from damage during construction and associated activities.

(3) Damage sustained by a tree, such as broken limbs, roots, or scarred trunks, including compaction damage, shall be repaired by the permittee.

(4) The Forest Service shall supervise the measures taken to protect and repair roadside trees under this section.

D. Protection of Tree Roots.

(1) When an underground project subject to §C of this regulation encounters the roots of a roadside tree, a permittee, in accordance with the guidelines in §D(2)-----(15) of this regulation or other criteria approved by the Forest Service, shall tunnel or bore under the tree or modify the project to protect the tree's root system.

(2) For trees under 6 inches in diameter as measured 4 1/2 feet above average ground level, all machine digging shall stop at the dripline of the tree, or where specified by the Forest Service.

(3) For trees over 6 inches in diameter as measured 4 1/2 feet above average ground level, all machine digging shall stop when roots of 1 inch or more in diameter are encountered, or when specified by the Forest Service.

(4) Roots 1 inch or more in diameter may not be cut without approval of the Forest Service.

(5) A tunnel or other method of modification of the project under or around the tree shall be used if considered necessary by the Forest Service.

(6) The procedure noted in §D(5) of this regulation also shall be used to approach the tree from the opposite side.

(7) At least 24 inches of undisturbed earth shall remain over the tunnel or bore, or above other type of installation.

(8) For operations using shallow trenching techniques up to 12 inches deep, care shall be taken to minimize root damage and protect the trunk of the tree.

(9) Roots 1 inch or larger, damaged during construction, shall be sawed off close to the tree side of the ditch. Clean cuts shall be made at all times.

(10) Installations affecting roadside trees shall be completed in as short a time as possible to prevent the drying out of exposed roots.

(11) If considered necessary, the exposed root area within the ditch shall be watered and fertilized as directed by the Forest Service.

(12) Tunnels shall be refilled and the soil tamped tightly to original firmness.

(13) Trenches shall be filled to achieve and maintain original grade.

(14) Excess soil shall be removed from the site or disposed of as directed by the Forest Service.

(15) Unless otherwise directed by the Forest Service, the ground shall be fertilized and reseeded, cover shall be restored, and other procedures shall be followed as necessary to prevent erosion around trees.

E. Violations of Roadside Tree Standards.

(1) The Forest Service may require a person who fails to comply with §C or D of this regulation to:

(a) Remove and replace a tree which dies within 1 year after the treatment activity is completed;

(b) Document for 3 years the condition of a tree which shows decline within 1 year after the treatment activity is completed; and

(c) Remove and replace a tree which dies after 3 years following the completion of the treatment activity, if the tree has been the subject of the documentation in §E(1)(b) of this regulation.

(2) The value of a tree to be replaced is determined as of the date of the violation.

When highway construction using State funds causes the cutting or clearing of one acre or more of forests lands, the **Maryland Reforestation Law** requires that these trees be replaced. Replacement of forest cleared for highway construction must be accomplished on an acre-for-acre, one to one ratio on public lands and within a year of the completion of the project.

The **Maryland Forest Conservation Act** states that any activity requiring an application for a subdivision, grading permit or sediment control permit on areas 40,000 square feet or greater is subject to the Forest Conservation Act and will require a Forest Conservation plan.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Biology and Physiology

Version 5.1

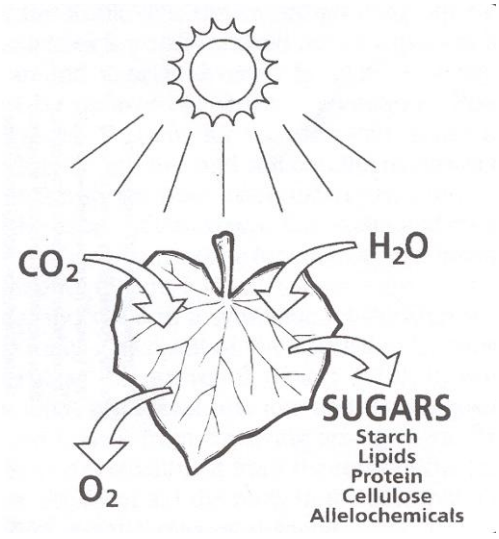
Cells are the basic building blocks of life. In plants, new cells come from the division of existing cells. Tree cell division occurs in structures called meristems. Following division, cells undergo differentiation, which changes structure and allows cells to assume specific functions.

Primary meristems are located at the ends of shoots and roots and are called apical meristems. Lateral buds may be inhibited by the active growth of terminal buds. This is called apical dominance.

Trees are divided into three major parts: crown, stem, and root system. The leaves and the branches that hold them make up the crown. The trunk is the main structural support and transports the water and nutrients up from the roots and the sugar and starches made in the leaves down to the rest of the tree.

Trees that lose their leaves every year are called deciduous. Trees that hold their leaves for more than one year are called evergreen. Needles and scales of conifers perform the same function as leaves of broadleaf trees.

Leaves are the food producers of the tree. Leaf functions include photosynthesis, transpiration, and respiration. Photosynthesis is the process of turning carbon dioxide and water into simple carbohydrates and oxygen using the energy of the sun. It is the process by which green plants use light to build sugar molecules. Literally photosynthesis means "putting together with light." Six molecules of water plus six molecules of carbon dioxide produce one molecule of sugar plus six molecules of oxygen, 6H2O + 6CO2 ----------> C6H12O6+ 6O2.



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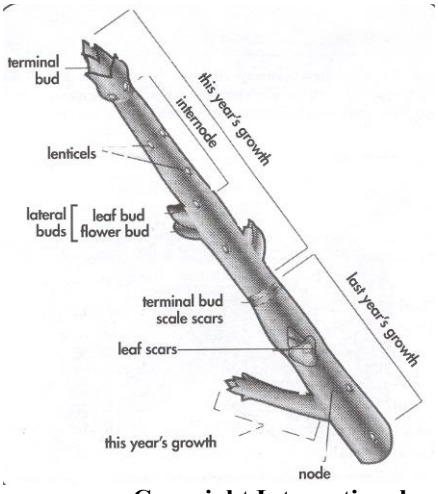
Much of the photosynthate is stored in the form of sugar or starch in the twigs, trunk and roots for later energy requirements. The energy created and stored by photosynthesis must be greater than the energy used in respiration. Otherwise, the tree must use its energy reserves. If this occurs over time, the tree may run out of energy reserves and die.

Fall color results from the breakdown of green chlorophyll in the leaves and the expression of other pigments which are always present. Anthocyanins produce the reds and purples; carotenoids the yellows, oranges and reds.

Respiration is the process by which chemical energy is used by the tree for all of its biological functions. In this process, the bonds of sugars and starches are broken, yielding energy, carbon dioxide and water. Respiration occurs at all times. Oxygen is required for normal respiration to occur. The oxidation of organic compounds in living cells releases stored energy, as fuel for the many life processes of the tree.

Transpiration is the loss of water in the form of water vapor from leaf surfaces. The evaporation of water cools the leaves & creates a "transpirational pull" that moves water up through the xylem. About 95% of the water absorbed by a plant is transpired. The rate of transpiration is affected by temperature, humidity and available water. Transpiration is also affected by cuticle thickness, presence of hairs on the leaf surface, and number and location of stomata. For example, plants with thick cuticle, small leaves, and sunken stomata are adapted to hot & dry conditions.

Twigs are small stems that provide the support structure for leaves, flowers and fruit. Branches support the twigs. Buds can occur along the twig, at the base of each leaf, just under the bark, or at the tip of each twig. A bud is an unexpanded shoot or flower. Terminal bud scale scars are useful in measuring annual twig elongation. You can measure a tree annual growth by measuring the distance between terminal bud scale scars, or nodes. The area between two nodes is known as an internode.



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The flower is the reproductive unit of some trees. Parts of the flower include petals, sepals, one or more carpels (the female reproductive organs), and stamens (the male reproductive organs). A complete flower is one that contains all four floral organs: petal, sepal, stamen, carpels.

Tree fruit takes many shapes and forms. Angiosperms are flowering plants whose seed is enclosed in an ovary. Gymnosperms or "naked seeds" plants whose seeds are borne with no outer covering.

The stem of the tree functions in the conduction of water and minerals, to support of the tree, and in the storage of reserves. The outer covering of a tree branches and stem is the bark. It functions to moderate temperature, to defend against insects and injury, and reduce water loss. Small openings in the bark, lenticels, allow for gas exchange.

The cambium is a thin, continuous sheath of radially dividing cells that produces the xylem (to the inside) and the phloem (to the outside). Phloem carries sugars and food down

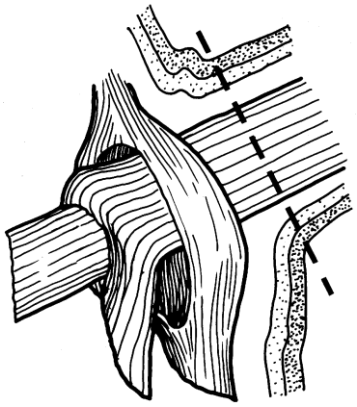
from the leaves to the rest of the tree. Xylem carries water and nutrients up from the roots to the rest of the tree.

The xylem, (the area of active, living wood) functions to transport water and nutrients, store food and water, and provide support for the tree. It can be thought of as a continuous column of water, where the evaporation of molecules from the leaves pulls the water up through the tree. Xylem is called sapwood. Farther inside the tree is dark wood called the heartwood. It is composed of dead cells and provides support for the tree.

Growth rings are the annual production of xylem by the cambium. They are visible because of the contrast between earlywood growth (light color) and latewood growth (dark color).

Radial transport is the horizontal movement or water or nutrients between cells through ray cells. Rays are channels of cells where water, nutrients & carbohydrates move laterally. Xylem rays in the sapwood are the pathways for food movement to and from the phloem.

The annual production of layers of tissue at the junction of the branch to the stem forms a shoulder or bulge called the branch collar.



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Reaction wood is wood altered to counteract a lean in a tree. Reaction wood is specialized secondary xylem that develops in response to lean or similar mechanical stress to restore the stem to vertical. Conifers form compression wood as a type of reaction wood. In hardwoods, cell walls thicken on the upside of the lean; hardwoods have tension wood as a type of reaction wood.

Excurrent trees have strong apical control, strong central leader, and a cone-shaped crown. Decurrent trees have weak apical control, no strong central leader, and a diffuse crown.

The root system of tree may comprise 1/3 to 1/2 the entire volume of a tree. The roots serve four primary functions:

1. Anchorage
2. Storage

3. Absorption
4. Conduction

Water and essential elements are absorbed from the soil by the roots. Some water is used for growth and metabolism, but most lost through evaporation. This water loss creates "transpirational pull" that moves water through the xylem. Too little or too much soil moisture can result in leaf-water deficits. Water deficits can cause slowed photosynthesis, stomatal closure, and wilting leaves.

If the water potential is lower in the soil, water will actually move out of the roots into the soil. For example, when salt concentrations are high in the soil from deicing or excessive fertilization application, water can be drawn out of the roots causing "fertilizer burn."

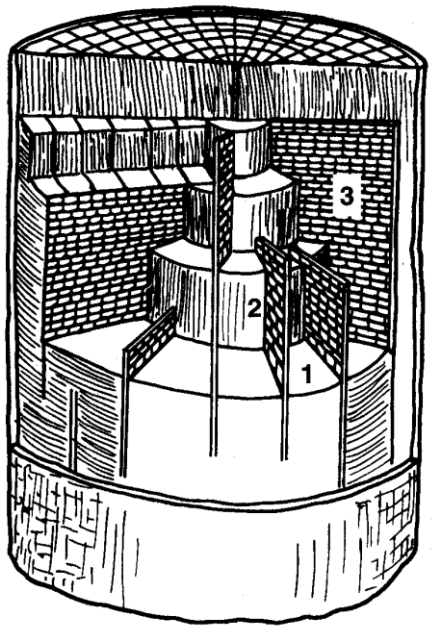
Many roots live in a symbiotic relationship with certain fungi. The result is termed mycorrhizae (fungus roots). The fungi aid the roots in absorption of water and essential mineral elements while the fungi derive nourishment from the roots. Mycorrhizae increase the roots' ability to absorb water and essential elements. Mycorrhizal fungi are essential to the health of all plants. They form a symbiotic (mutually beneficial) association with the roots of the tree and act as an extension of the tree's root system by increasing their absorption of water and nutrients. Mycorrhizal fungi produce structures called hyphae that allow the them to forage for some nutrients more effectively than roots alone. The fungi transfer some of these nutrients to the root and receive carbohydrates from the root.

Because the relationship between trees and mycorrhizae is symbiotic, both the tree and the fungi extract some benefit. Mycorrhizae are more effective than tree roots at accumulating water and nutrients, and can store excess nutrients, releasing them to the tree as needed. Nutrient uptake, particularly that of phosphorus, is enhanced in infertile soils because mycelial strands and their protruding hyphae explore the soil more extensively than nonmycorrhizal roots. The fungi also inhibit invasion by damaging fungi, and extend the life to root tips. Mycorrhizae release acids that break down substances that the tree cannot use without this help, and fix nitrogen from both the soils and atmosphere so that it is more available to the tree. Mycorrhizal fungi produce hormones that encourage the production of new root tips, which aids both the tree and the fungi.

The symbiotic relationship between mycorrhizae and trees benefits the fungi as well. Fungi cannot manufacture their own food due to lack of chlorophyll, a process that converts sunlight to energy used for producing sugars. Therefore, fungi must get this food from chlorophyll-producing plants. They do so by either penetrating the plant roots or forming a sheath around the root tips. This energy allows the fungi to reproduce and form large networks within the soils.

Compartmentalization is the process by which trees react to injury by forming physical and chemical barriers to contain the injury and its effects. After a tree is wounded, reactions are triggered to form boundaries around the wounded area. A model of this process is called CODIT = **C**ompartmentalization **O**f **D**ecay **I**n **T**rees. Trees form four walls around a decayed area:

Wall 1 – stops decay spreading vertically;
Wall 2 – limits decay spread inward;
Wall 3 – Limits lateral spread of decay;
Wall 4 – stops decay spread outward to new wood growth



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It is fairly common for wall 1, 2 and 3 to fail. Wall 4 rarely fails, except where canker-causing fungi restrict its development or kill the cambium. Wall 4 is considered to be the strongest wall.

Wall 4 forms to stop the spread of decay to the new wood growth as the tree grows radially.

Wall 4 has completely closed to prevent decay from spreading to new wood as the tree grows out around it.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Nutrition, Fertilization, Soil, and Water

Version 5.1

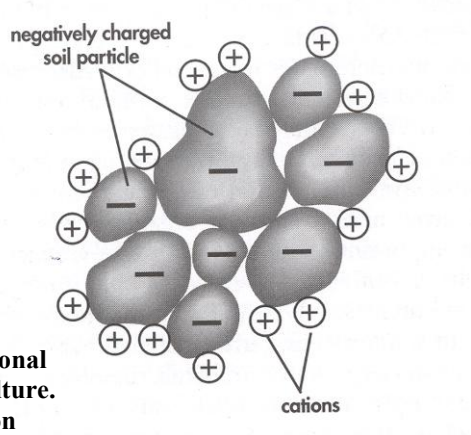
Soil is very important to plant health and success. It provides plants with nutrients, root anchorage, and water.

Though soil appears solid when you look at it with the casual eye, the ideal soil is made up of solids and voids. An ideal soil is 50 percent solids and 50 percent pore space, which contains water and air. The solid portion is mostly mineral soil with a percentage of organic matter. The voids are pore spaces or gaps between the particles of soil. The pore spaces allow for air and water exchange and uptake by plant roots.

The term soil texture refers to the size of the particles in the soil. There are three main types of particles: sand, silt, and clay. Sand is the largest, clay the smallest, and silt is intermediate. Because sand particles are the largest, sandy soils drain very well but do not hold water well. Soils with high clay content do not drain well. They hold water and flood easily because they have fine particles and little pore space. Most soils have some combination of the three soil types. A loam soil combines the desirable attributes of each particle size, exhibits intermediate characteristics, and is ideal for growing a wide variety of plants.

When all pores (micropores and macropores) in the soil are filled with water, the soil is considered to be saturated. When excess water drains away and soil pores are primarily filled with air but water is held by the soil particles, the soil is considered to be at field capacity. This is a desirable state as plants have both air and water available. When both the water in the pore spaces and the water held by the soil particles are gone, drought conditions begin. Plants in drought conditions may wilt due to water loss and ultimately reach the permanent wilting point when the water is held so tightly by the soil particles that it is unavailable to the plants. This is "the point of no return" for plants – the point at which they will die if adequate water is not added to the soil.

The capacity of a soil to adsorb (gather) positively charged ions is called its cation exchange capacity (CEC). The CEC of a soil can be determined by a soil test. It is important because it indicates the ability of a soil to attract and hold elements and nutrients that plants need for growth, and is a measure of soil fertility.



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The term "pH" refers to the acidity or alkalinity of a soil. The soil pH can also be determined by a soil test. The pH is important because various nutrients required by plants bind to the soil and become unavailable at certain pH ranges. This is why the ANSI (American National Standards Institute) standards state that soil pH shall be considered when selecting a fertilizer. The pH of the soil may limit the availability of a nutrient even if you apply a considerable amount of it. The pH range varies depending on the nutrient in question, and is one reason why certain plants flourish in a particular pH range.

Compaction, one of the biggest problems in urban soils, can be caused by pedestrian and vehicular traffic or grading and other construction activity. In preparing soils for structures, roads, and pavement, engineering specifications usually require that load-bearing soil be compacted to 90-97% compaction. While this compaction provides stability to buildings and other improvements, it is bad for trees. When compacted to meet load-bearing engineering specifications, soil is almost impenetrable to roots. The best way to address soil compaction is to prevent it. Compacted soils are difficult to remedy after the fact. Sometimes people try to remedy compaction by adding organic material to the soil, but in most cases this will not be of any particular benefit. Remember, a good soil is mostly mineral soil with a lot of pore space. Once the soil structure is destroyed by compaction, it is hard to get those pore spaces back.

Mycorrhizae are fungi that live in a symbiotic relationship with roots, and increase the roots' ability to absorb water and essential elements. These occur naturally in forest soils but may be lacking in urban soils. Many urban soils are low in organic matter due to the fact that nutrient cycling is often interrupted because plant debris (leaves, etc.) is generally removed from the soil surface. In forests, leaf litter decomposition creates a zone of complex biological activity that is beneficial to trees. In urban areas, these processes are often simulated through the use of organic mulch.

The most beneficial times to irrigate plants are late at night or in the early morning. Evaporation is minimized and the foliage has a chance to dry during peak daylight hours, reducing the opportunity for the spread of fungal pests if watering is done in the early morning. Antitranspirants are sometimes used to reduce plant water loss through transpiration. They are best used over short periods of time, and a proper soil moisture regimen is preferable. Tensiometers are soil moisture sensors used to measure soil wetness or dryness. They can be useful in establishing and monitoring the soil regimen for plants being managed.

Fertilization shall not be undertaken without establishing an objective. Why are you fertilizing the plant? To induce growth? To make up for a nutrient deficiency in the soil? Knowing why you are fertilizing will drive other decisions in the process such as fertilizer type and rate. A nutrient is an element or compound required for plant growth, reproduction or development. Nutrients are categorized as macronutrients (needed in relatively large quantities by plants), secondary nutrients (needed in relatively moderate quantities by plants), and micronutrients (needed in relatively small quantities by plants). These nutrients are listed in Table 1.

Nutrient	Symbol	Type
Nitrogen	N	Macronutrient
Phosphorous	P	Macronutrient
Potassium	K	Macronutrient
Sulfur	S	Macronutrient
Calcium	Ca	Secondary nutrient
Magnesium	Mg	Secondary nutrient
Iron	Fe	Micronutrient
Manganese	Mn	Micronutrient
Zinc	Zn	Micronutrient
Copper	Cu	Micronutrient
Boron	B	Micronutrient

Table 1 - Nutrients

The nutrient to which plants most commonly respond is nitrogen. Nitrogen is what most fertilization prescriptions are based on. Soil and/or foliar nutrient analysis should be used to determine the need for fertilizer. In the absence of soil and/or foliar nutrient analysis, fertilizers with higher ratios of P_2O_5 (phosphorus) and K_20 (potassium) should be avoided. Nitrogen often comes in salt form. However, salts can dry out and damage plant tissues (this is where the phrase 'fertilizer burn' comes from). This is why ANSI standards say that fertilizers with a salt index of less than 50 should be preferred.

A fertilizer analysis is the composition, expressed as a percentage by weight, of nutrients in the fertilizer. A fertilizer that contains nitrogen, phosphorous, and potassium is called a complete fertilizer. The three numbers listed on the packaging of a complete fertilizer stand for the percentages of nitrogen, phosphorous, and potassium present. For example, a 100 pound bag of 10-10-10 fertilizer has 10% each of N, P, and K, and so contains 10 pounds of nitrogen, 10 pounds of phosphorous, and 10 pounds of potassium. A 140 pound bag of 10-10-10 fertilizer also has 10% each of N, P, and K, but has 14 pounds of nitrogen, 14 pounds of phosphorous, and 14 pounds of potassium.

Slow-release fertilizers should be applied at rates between 2 and 4 pounds of actual nitrogen per 1,000 square feet. However, slow-release fertilizers should be applied at rates that do not exceed 6 pounds of actual nitrogen per 1,000 square feet within 12 months. This is important if you plan to fertilize more than once per year. Quick-release fertilizers should be applied at rates 1 and 2 pounds of actual nitrogen per 1,000 square feet.

How do I calculate the amount of fertilizer needed? You need to know the following things:

- The size of the area to be fertilized. According to ANSI standards, the fertilization area is determined by the tree expert or arborist, based on site considerations.
- The amount of nutrient (normally based on the amount of nitrogen or N) you want to apply per 1,000 square feet of area to be fertilized. This will vary

depending on whether you are using slow-release nitrogen or quick-release nitrogen as noted above.

- The fertilizer analysis for the fertilizer you intend to use (i.e., 10-10-10, 46-0-0, etc.).

Example: If applying ammonium nitrate (16-20-0), how many pounds of fertilizer should be applied to a 5,000 square foot area to apply 2 pounds N per 1,000 square feet?

Solution:
Size of area to be fertilized = 5,000 square feet
Amount of N = 2 pounds per 1,000 square feet (again, this number will vary depending on whether slow-release or quick-release fertilizer is used and what the soil analysis recommends).
Fertilizer analysis: 16-20-0 (16% N, or 0.16 N)

Use the general formula –

$$\frac{\text{Fertilization area } (ft^2)}{1000} \times \frac{\text{N application rate (lbs. N per 1000 } ft^2)}{\text{\% nitrogen in the fertilizer (decimal form)}} = \text{lbs. of fert.}$$

$$\frac{5{,}000 \text{ sq. ft.}}{1000} \times \frac{2 \text{ (lbs of N per 1000 } ft^2)}{0.16} = 62.5 \text{ lbs. of fertilizer}$$

To check: 62.5 lbs of fertilizer x 0.16 (percentage of N) = 10 lbs of N.

The preferred method of fertilizer application where turf or ground covers exist is sub-surface liquid application. However, other methods may also be used. When applying a sub-surface liquid fertilizer injection, injection sites should be 12 inches to 36 inches apart, and 4 inches to 8 inches deep.

Maryland Licensed Tree Expert Exam Study Guide

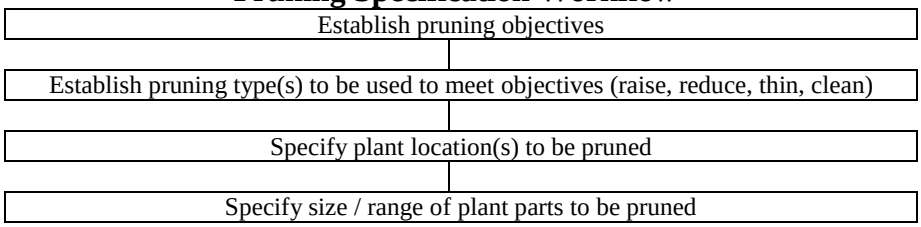
For Exam Domain:

Tree Pruning

Version 5.1

Pruning is defined as the selective removal of plant parts. Pruning objectives shall be established prior to beginning any pruning operation. Specifications for pruning are to include the location and size range of parts to be removed, the pruning objectives, and the pruning type or types to be employed.

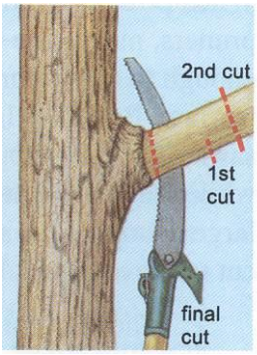
Pruning Specification Workflow



Equipment and work practices that damage living tissue and bark beyond the scope of work should be avoided. Climbing spurs shall not be used when climbing and pruning trees, except in special circumstances as noted in ANSI (American National Standards Institute) A300 (Part 1) Pruning (exceptions: emergency situations; when limbs are more than a throw-line distance apart and there is no other means of climbing the tree; when the outer bark is thick enough to prevent damage to the inner bark or cambium; and, in remote or rural utility rights-or-way).

Branches with strong U-shaped attachment should be retained while branches with a V-shaped attachment and included bark should be removed. A pruning cut that removes a branch at its point of origin shall be made close to the trunk or parent limb without cutting into the branch bark ridge or collar and without leaving a stub. A pruning cut that reduces the length of a branch or parent stem should bisect the angle between its branch bark ridge and an imaginary line perpendicular to the branch or stem. To prevent damage to the parent limb when removing a branch with a narrow branch attachment, the final cut should be made from the outside of the branch inwards.

If a limb is large enough that the cambium may rip during pruning, it should be removed by making three cuts. The first cut eliminates the chance of bark tearing as the limb is removed. The second cut allows the limb to drop smoothly when the weight is released. The third cut removes the remaining stub. Severed limbs shall be removed from the crown upon completion of the pruning, at the end of the workday, or at times when the tree will be unattended. When necessary, ropes or other equipment shall be used to lower large branches, or portions of branches, to the ground. Limbs that cannot be safely controlled by hand or free-dropped shall have a separate rigging line tied to them to help control their fall.



How To Prune Trees
USDA Forest Service
NA-FR-01-95

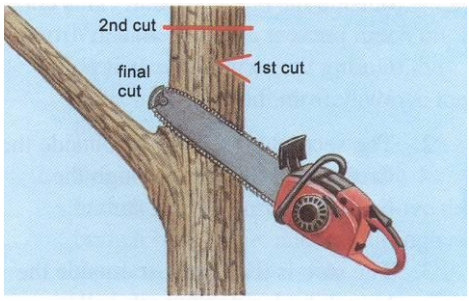
Flush cuts are not recommended as ring shakes, discolored wood, and greater decay are associated with flush cuts.

Wound treatments should not be used to cover wounds or pruning cuts, except when recommended for certain specific reasons.

Topping is defined by ANSI A300 as the reduction of tree size by cutting live branches and leaders to stubs, without regard to long-term tree health or structural integrity. Topping is not an acceptable pruning practice. Topping is NOT an alternative term for crown reduction, directional pruning, drop-crotch pruning, or lateral pruning and is different than pollarding. Topping has been shown to increase the risk of tree failure.

A heading cut is defined as the reduction of a shoot, stem, or branch back to a bud or lateral branch not large enough to assume the terminal role. Heading should be considered an acceptable practice for shrub pruning and specialty pruning, but not for other types of pruning. For most conifers, if branches are headed back to older wood with no foliage the branch stub usually dies. Cutting back to a lateral that is insufficient in size is much like topping.

A reduction cut is used to reduce the size of a tree. A reduction cut removes a stem or branch back to a lateral branch or stem that is large enough to assume the terminal role. This lateral branch should be at least one-third the diameter of the removed portion. When possible, avoid large reduction cuts (more than 2 inches diameter) on permanent scaffold limbs.



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To obtain the defined objective, the growth cycle of the species, the structure of the species, and the type of pruning to be performed should be considered. Not more than 25 percent of the foliage of a branch or limb should be removed in a single growing season when it is cut back to a lateral, and that lateral should be at least 1/3rd the diameter of the removed portion so that it can assume apical dominance. The Maryland Department of Natural Resources Forest Service recommends that not more than 25 percent of the foliage on a mature tree should be removed within a growing season.

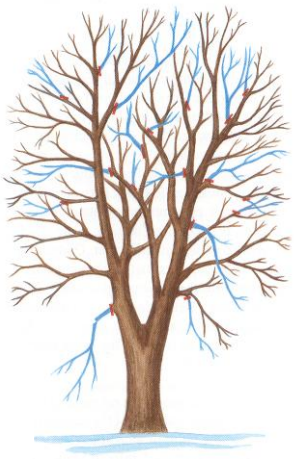
Excessive removal of the laterals and foliage from the interior portion of a branch is called lion's tailing. The negative effects of lion's tailing include reduced branch taper, sunburned bark tissue, and weakened branch structure and breakage. Topping and lion's tailing shall be considered unacceptable practices for pruning trees.

Pruning Types

Structure pruning is the selective removal of live branches to improve tree and branch architecture primarily on young- or medium-aged trees. The size and location of leaders or branches to be subordinated or removed should be specified. The dominant leader(s) should be selected for development and strong, properly spaced scaffold branch structure should be selected and maintained by reducing or removing others. Interfering, overextended, defective, weak, and poorly attached branches should be removed or reduced.

Crown cleaning is the selective removal of dead, diseased, detached, and broken branches. The location of parts and the size range of parts shall be specified.

Crown thinning is the selective removal of live branches to reduce crown density. Thinning should result in an even distribution of branches on individual branches and throughout the crown. The percentage of foliage, the location and size of parts to be removed shall be specified.



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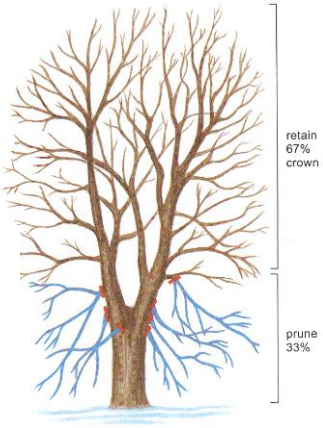
Crown raising is the selective removal of branches to provide vertical clearance. The location and size range of the parts to be removed should be specified. The clearance distance shall be specified. After pruning, the ratio of live crown to the total tree height should be at least two-thirds.



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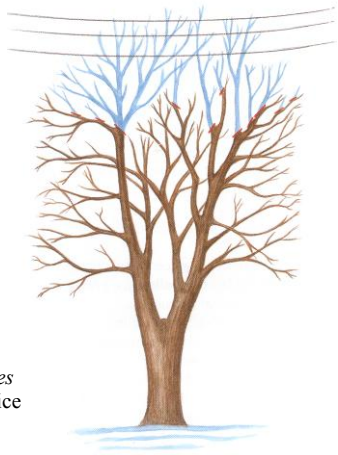
Crown reduction is the selective removal of branches and stems to decrease the height and/or spread of a tree. Consideration shall be given to the ability of a species to tolerate this type of pruning. The location of parts to be removed and the clearance requirements shall be specified. The size of parts should be removed. This method, sometimes called drop crotch pruning, is preferred to topping because it results in a more natural appearance, increases the time before pruning is needed again, and minimizes stress to the tree. Crown reduction should be accomplished with reduction cuts, not heading cuts.



How To Prune Trees
USDA Forest Service
NA-FR-01-95

Crown restoration consists of selective removal of branches, sprouts, and stubs to redevelop structure, form, and appearance of severely pruned, vandalized, or damaged trees. The location and size range of parts, and the percentage of sprouts to be removed should be specified.

Pollarding is a tree training system that involves severe heading the first year followed by annual sprout removal. Pollarding is not topping. Management plans shall be made prior to the start of the pollarding process for routine removal of sprouts. Consideration shall be given to the ability of the individual tree to respond to pollarding.

Vista pruning consists of the use of one or more pruning methods to enhance a specific line of sight. Pruning methods shall be specified. The size range of parts, location in tree, and percentage of foliage to be removed should be specified.

Espalier is a combination of pruning, supporting, and training branches to orient a plant in one plane. Ties should be replaced as needed to prevent girdling the branches at the attachment site.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Problem Diagnosis

Version 5.1

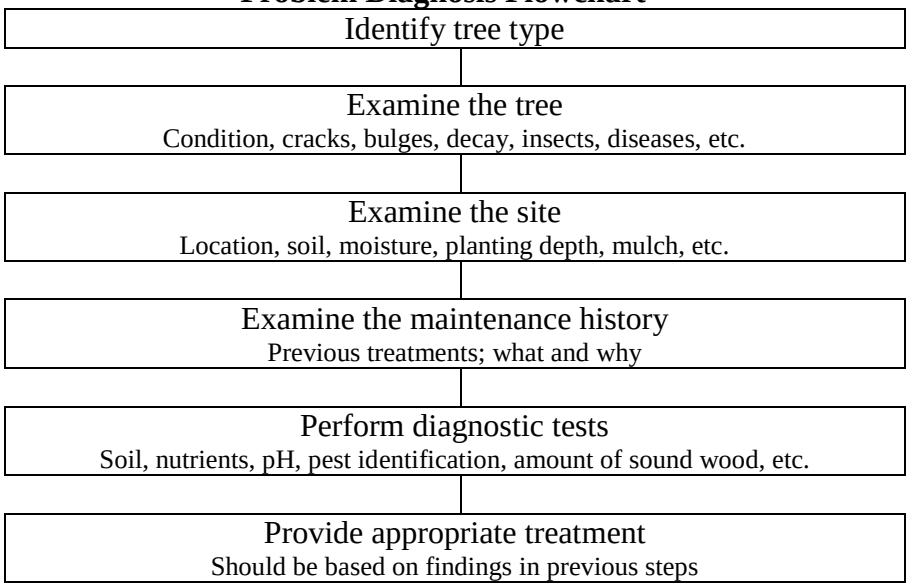
Trees often decline or experience problems due to multiple factors. Problem diagnosis is more complex than simply looking for the first insect or disease you can find and then declaring that the problem has been identified. If a person has a cough, they may have a cold or they may have cancer. A diagnosing physician would want to ask the patient about the problem they are experiencing, examine the patient's medical history (previous history of disease, smoker/non-smoker, etc.), examine the patient's family's medical history (family history of heart disease, cancer, etc.), and perform certain standard diagnostic tests (blood pressure, temperature, etc.). A tree diagnostician should follow a similar pattern of research, observation, and testing to diagnose and recommend treatment for a tree. Proper steps in diagnosis of tree problems include:

- Tree identification. What type of tree are you diagnosing? The "Family history" of the tree is very important, as certain pests are specific to certain species, genera, or families of plants.
- Looking for something out of the ordinary. The *Body Language of Trees* tells us that trees grow in a logical way, and if something looks unusual it means that something may be wrong. Learning how to read these signs can help you understand what the tree is "telling" you about its condition. Trunk lean, decay fungi, root plate heaving, bulges on trunks, and spots on leaves all indicate potential problems. Trees will tell you what the problem is if you look carefully and thoroughly at the entire tree: roots, stem, and crown.
- Examination of the site around the tree. Trenching, ground disturbance, herbicide application, storm damage, and other factors that could affect tree health may be revealed by examining the site surrounding the tree.
- Examination of any available site maintenance history. The "medical history" of a tree, if available, should provide background on attending tree experts and arborists and treatments performed. You may be able to contact prior practitioners to confer on what was done and why, or find a pattern of previous problems based on prior treatments performed.
- Performing certain diagnostic tests, if appropriate. A soil test can provide information on nutrient deficiencies or pH problems.

Invasive but useful tools for evaluating tree growth include the increment borer and various types of decay detection equipment. These tools can allow the tree expert to examine changes in tree ring growth over time.

Non-invasive tools for evaluating the extent of internal decay include tools using radar technologies or sound waves. These tools can detect the quantity and quality of remaining wood without disturbing the wood of the tree. Root collar excavations, whether performed solely by hand or with mechanical assistance, can reveal stem girdling roots, whether a tree was planted too deeply, or whether the burlap and twine or wire basket was removed at planting.

Problem Diagnosis Flowchart



Injuries caused by ice, lightning, or pesticides are examples of impacts from abiotic (non-living) factors. In urban areas, most tree failure occurs as a result of storms. If a vertical strip of bark is missing from a point in the crown down to the ground, with a rough groove that follows the grain of the wood, a likely cause is a lightning strike. Other abiotic disorders include damage from temperature extremes, pollution damage, and chemical injury (normally from herbicide misapplication).

Diseases caused by bacteria, nematodes, or fungi are examples of impacts from biotic (living) factors. Anthracnose is a name for a group of diseases caused by several closely related fungi that attack many shade trees. It is common on the foliage and twigs of ash, sycamore, maple, and white oak. The anthracnose fungi can also attack walnut, hickory, elm, birch, catalpa, linden, planetree, tuliptree and horsechestnut. Symptoms moving from the bottom of the tree upward are typical of anthracnose. Shade tree anthracnose is separate from dogwood anthracnose, which is a different disease caused by a much more virulent fungus that requires early and aggressive management.

Discula anthracnose (dogwood anthracnose) is a serious disease which can kill flowering dogwood trees. It is caused by a fungus. Early in the spring, anthracnose fungi may kill twigs and newly expanding leaves, causing symptoms that resemble frost injury. Small, sunken dead areas, cankers can girdle the branches. Infections of the leaves or leaflets can cause dead blotches along leaf veins and sometimes distortion. Infected leaves and leaflets may drop from the tree, causing defoliation.

Holes in the bark with visible frass may be caused by borers. But if the holes are in uniform horizontal bands around the trunk without any frass, they are likely caused by sapsuckers. Insects with chewing mouthparts include borers, caterpillars, and leaf miners and do not include mites.

Sign or symptom	Possible cause
Sooty mold	Infestation by aphids or scale
White to gray-white fungus on leaf and shoot surfaces	Powdery mildew
Canker (localized dead tissue) on stem or branch	Wounding or disease
Dark, discolored streaks in the young xylem	Verticilium wilt, vascular system disease
Root galls	Insects, nematodes, or nitrogen-fixing bacteria
Mushrooms or conks	Decay fungi
Lack of trunk flare on a portion of the trunk at the soil line	Stem girdling root
Small emergence holes in the trunk or branches with frass (looks like sawdust)	Wood-boring insects
Holes in the leaves	Insects or diseases
General yellowing of leaves (chlorosis)	Sucking insects, pH problems, nutrient deficiency
Wilting of leaves	Lack of water, vascular system disease

In some cases the most obvious pest is not the primary culprit. Sucking insects, though easy to detect, are not normally primary causes of tree death. Some apparent clues do not indicate anything. For example, exfoliation (peeling) of the bark on a mature plane tree (*Platanus x acerffolia*) is normal. However, peeling bark on a type of tree that does not have exfoliating bark under normal conditions would be a cue for further assessment.

Some plant pests travel on their own. Some are carried by vectors (carriers). Elm yellows and Dutch elm disease are both examples of diseases that are often transmitted by insect vectors. Bacterial Leaf Scorch is thought to be transmitted by insect vectors. Some pests are transported by people. Emerald Ash Borer was introduced into Maryland on infested nursery stock. It attacks ash trees and leaves small D-shaped exit holes. The Asian Longhorned Beetle has not yet been detected in Maryland.

When collecting samples for the purpose of diagnosing plant problems, it is important to collect samples that include the transition from diseased tissue to healthy tissue so that the diagnostician can compare the healthy and infested portions of the plant.

Tree experts and arborists often are requested to perform risk tree assessments. The need for risk tree assessment is normally based on the premise that personal injury or property damage could result if a certain tree failed. Because liability is possible, such assessments should be documented in writing. People, structures, improvements, and vehicles are potential targets for hazardous trees. An unsound tree in an area with no target is not a hazard. If a previously unimproved area becomes developed, there may be a corresponding change in the need for tree assessment. Sometimes the risk of failure may be due to the type of tree – fast-growing trees are usually weak-wooded and failure prone. The tree expert will normally read the tree's "body language" for things out of the ordinary, including:

- longitudinal cracks or splits in the trunks or branches (indicate a high risk of failure);

- branches or stems that lack taper;
- codominant stems or branches;
- An external swelling or bulge (a likely indicator of internal decay or a cavity);
- An external rib on a tree (a likely indicator of an internal crack);
- Cracks or lifting of the soil on the opposite side of the lean on a leaning tree likely indicates movement of the root system, soil failure, and/or pending tree failure.

Decay which only affects the dead tissue in the center of the tree is normally referred to as heartrot. Most experts agree that 30-35 percent loss of stem diameter due to heartrot requires that some action be taken to address the risk of failure. Mushrooms or conks on a trunk or branch indicate a need for further assessment to determine whether or not internal decay is present.

Brown rots are fungi that consume cellulose, resulting in wood that is stiff but brittle like a hard biscuit and subject to failure without warning. White Rots are fungi that consume both cellulose and lignin, resulting in soft flaky or stringy decay that is whitish to reddish brown in color.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Selection, Installation and Establishment

Version 5.1

The most important part of tree selection is matching the tree with the site. We want to:

Plant the right tree …

In the right place …

For the right reason.

Consider the following when selecting a tree:

Site considerations

- Adaptability – tree's genetic ability to adjust to different conditions;
- Acclimation – process by which a tree adapts to its environment;
- Climate – hardiness zone, moisture availability, light, winds;
- Soil - soil test, texture, pH, nutrients, compaction;
- Space - growing space – above and below, nearby signs, buildings, and utilities overhead and underground;
- Other plantings – turf, other shrubs and trees nearby;
- After planting maintenance needs – irrigation, watering.

Tree considerations

- Size- size, height and width at maturity;
- Growth rate - fast or slow growing;
- Fruit, litter - fruit problems, fall color, flowers, bark, wildlife food, litter, thorns;
- Water needs – enough water available for that species;
- Light needs – is tree shade tolerant or intolerant;
- Pest problems - insect and disease problems in the area;
- Hardiness - able to survive low or coldest temps in the area.

Planting purpose

- Aesthetics;
- Engineering;
- Architectural;
- Screening;
- Shading.

Try to select a tree to fit all three factors if possible – you may have to compromise.

Some other considerations

- Functional uses of the tree;
- The tree's ability to adapt to the site;
- The amount of care the tree will need after planting.

If the site is underneath overhead utility lines, you should not plant a tall-growing tree in that location. Plant a small scale tree with decurrent branching pattern.

The term "plant hardiness" refers to the ability of a plant to tolerate the coldest temperatures experienced in a particular area.

All plant material should conform to American Standards for Nursery Stock ANSI (American National Standards Institute) Z60.1. Required general specifications include for bare root and field grown stock, specifications shall include plant size, by height or caliper, as appropriate to the plant type. For container grown stock and box-grown stock, specifications shall include plant size, by height or caliper, as appropriate to the plant type, and container class or box size.

ANSI Z60.1 gives definitions and standards for all types of trees. Types of trees include:

- Type 1 – shade trees;
- Type 2 – shade trees (slower growing than type 1);
- Type 3 – small upright trees;
- Type 4 – small spreading trees.

Types of coniferous evergreens include:

- Type 1 – creeping or prostrate;
- Type 2 – semi-spreading;
- Type 3 – broad spreading, globe, and compact upright;
- Type 4 – cone type (pyramidal);
- Type 5 – broad upright;
- Type 6 – columnar type.

For nursery stock less than four inches caliper size, caliper measurement of the trunk shall be taken 6 inches above the ground. For nursery stock greater than four inches caliper size, caliper measurement of the trunk shall be taken 12 inches above the ground. Bid specifications for trees for street plantings should specify the height to which the tree should be free from branching (branching height). Trees are generally available from nurseries in one of three forms:

- Bare-root - small, easy to plant, light weight, field grown, cheaper;
- Balled and burlapped - dug in nursery, may lose 95% of absorbing roots, cost more, heavier, wrapped in burlap;
- Containerized - plastic or natural pot with soil mix, bark, compost, peat, or sand.

Before accepting any planting stock, the soil level at the top of the root ball or container should be examined in order to determine if the root collar is at the proper level. Trees with soil

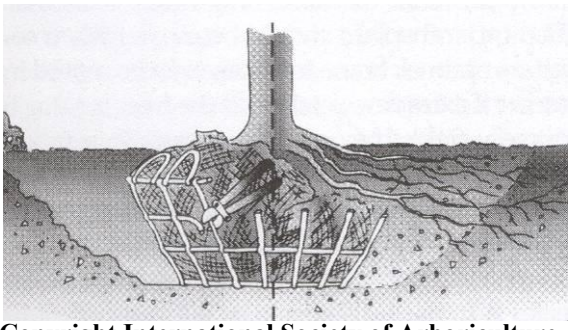
balls greater than 30 inches in diameter should be burlapped, followed by drum lacing with rope. Burlap shall be biodegradable and shall completely cover the root ball. Soil balls less than 18 inches diameter usually do not have to be reinforced with cord or rope unless soil is sandy and ball is apt to break apart.

When planting a bare root tree, dig the hole 2 to 5 times bigger than the diameter of the stem at the root collar. The side should be slanted and the depth the same or a little less than the root ball. The hole should then be domed in the middle and the tree set on the dome with the roots spread out around the dome. This will allow the roots loose soil to grow in. Do not expose roots to air as they will dry out. Because the tree as a limited root system, it might need staking.

Planting a tree with a tap root requires digging a hole deep enough to extend the root down straight beneath the stem. The hole should not be deeper than the extended tap root because the root collar will be covered by soil. Do not bend the tap root.

For balled and burlapped trees, remove the sod, loosen the soil, and slope the sides. Dig a hole a minimum of 1.5 times the diameter of the rootball, and slightly less than as deep, as the rootball. Make sure there are no glazed sides. Handle the trees carefully, not by the stem, to avoid root breakage. If drainage is problem, the root ball can be planted 1/3 the height of root ball above grade. To eliminate settling, the bottom of hole should remain undisturbed to give solid support to the root ball.

Cut the burlap and twine. Remove the burlap from the top and sides of the root ball. This will allow the roots to grow out the top and sides of the root ball. Fold the burlap down to avoid wicking. Remove completely if it is synthetic burlap. Remove the twine. The same is true of wire baskets. Completely remove or cut away as much of the wire as possible.



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Backfill with the same soil, unless it is very poor soil. In most cases, amending the soil with organic material will not be of any particular benefit. Make sure there are no air pockets and the trunk is vertical. Firm up the soil and water.

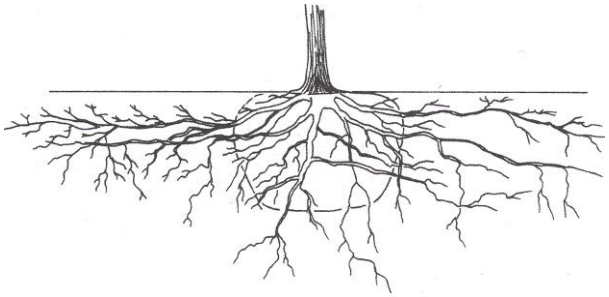
Under normal conditions, root growth is best encouraged by planting even with the surrounding terrain. In wet conditions where drainage is a problem, raising about 1/3 of the root ball above ground will aid the spread of lateral roots. In arid conditions, a basin can be used to collect water.

Make a berm to collect water, turn the grass upside down. Avoid concentrating water at the root ball to encourage root growth out into the surrounding soil. Remove the tags, labels, and tree guards.

A containerized tree may be root bound when delivered. Separate and cut the roots, especially any kinked or circling roots. This will encourage the roots to grow out into soil instead of continuing to grow in a circle around the tree. Circling roots are common in trees which were started in containers. Kinked and circling roots could reduce the growth of a tree, or even kill it. Remove the container before planting, unless it is biodegradable. The container shall not be removed by pulling or leveraging the trunk of the tree. Appropriate removal methods include, but are not limited to, bending, wiggling, and/or cutting the container.

When is the best time to transplant trees? For deciduous trees it is generally best to plant after leaf drop or abscission in the fall and before leaf out in the spring. If deciduous trees that have leafed out must be moved, the use of antitranspirants may be warranted to reduce the possibility that plants will reach the permanent wilting point before, during, or after transplanting. For evergreen trees, it is earlier in the fall and later into the spring than for deciduous. However, time to transplant can be species specific. Check first.

Root pruning helps before transplanting. Pruning should be done with sharp tools to make clean cuts. When a tree is harvested for transplanting, as much as 95% of the absorbing roots may be lost.



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When digging a tree for transport, a rule of thumb for the width of the root ball is a minimum of 10 inches root ball diameter for every one inch of trunk diameter. Make clean cuts and wrap with burlap if the root ball is greater than 18 inches. Balled and burlapped trees with large soil balls should be drumlaced with rope for additional support. Extra care must be given to trees with large tap root systems as they are harder to transplant than systems with fibrous root systems.

Anticipate the height and spread of the tree at maturity. Check the proximity of the tree's location to hardscape features and utilities. Check the shade tolerance of the tree compared to the photoperiod (the amount of time per day that a tree is exposed to light) on site.

Very large trees can be dug and transplanted by a mechanical device known as a tree spade. When using a tree spade, no attempt should be made to move trees that exceed the size limitations of the machine being used.

Staking is not always necessary. Staked trees often have smaller caliper, less trunk taper, and are more susceptible to tipping after the stakes are removed. Stake if the site is windy, has sandy soil, if it is a tall tree with a large canopy, or if there is a lot of pedestrian or equipment traffic in the area. If a single stake is used, place it on the upwind side.

Trees greater than four inches in diameter often require guying. Trees are guyed with three or four wires anchored to the ground. If installing trees over 8 inches in diameter, support the tree with four guy wires of ¼", 7-strand cable, 3/8" lag hooks, turnbuckles and deadmen. If using metal stakes, wooden stakes, or eye screws with turn buckles as devices for staking and guying, check several times a year to make sure that the tree is not being girdled and that the system is still intact.

Remove wires and tags to prevent girdling. Tree staking and wraps should not be left on for more than one year. If trunk wrap and staking materials are left on indefinitely, trunk girdling and constriction may occur.

Mulches are materials placed on the soil surface around the tree trunk to reduce moisture evaporation and improve soil conditions. Other benefits include minimizing turf and weed competition, reducing soil erosion, improving soil aeration, moderating soil temperature, and protecting against mechanical damage. The mulch layer should not exceed two to four inches in depth and should not be placed against the trunk, as collar rot can occur. It should be a minimum of three feet in diameter around the tree and can be as large as you wish.

Immediately after planting or transplanting, how should the young tree be pruned? According to ANSI standards, prune only dead or broken branches. If an evergreen, do not prune because there are no latent buds present. Do <u>NOT</u> prune the crown to balance it with the remaining root stock.

The rate of recovery and re-establishment after planting and transplanting varies with species. The general rule of thumb for re-establishment in temperate climates is one year for each inch of caliper.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Safety

Version 5.1

The ANSI Z133 Standards contain arboriculture safety requirements for pruning, repairing, maintaining, and removing trees; cutting brush; and for using equipment in such operations. All Maryland Licensed Tree Experts shall comply with these safety standards while working in the State of Maryland. **Each person**, employee or other, shall be responsible for his/her own safety and comply with the appropriate Federal and state occupational safety and health standards and all rules, regulations, and orders which are applicable to his/her own actions and conduct.

Employers shall instruct their employees in the proper use, inspection and maintenance of tools and equipment, including ropes and lines; and require that appropriate working practices be followed. A job briefing shall be performed by the qualified tree expert in charge before the start of each job. The briefing shall be communicated to all affected workers. Instruction shall be provided in the identification, preventive measures, and first-aid treatment of common poisonous plants (poison ivy, poison oak and poison sumac), stinging/biting insects and other pests indigenous to the area in which work is to be performed.

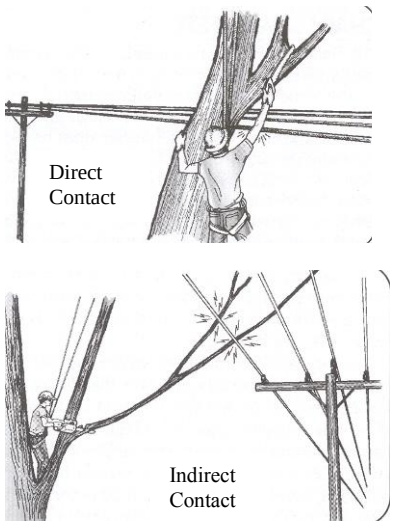
A first-aid kit, adequately stocked and maintained, shall be provided by the employer. Tree Experts and other workers shall be instructed in its use and specific location.

Clothing and footwear appropriate to the known job hazards shall be approved by the employer and worn by the employees. Workers shall wear head protection that conforms to ANSI Z89.1. Class E helmets shall be worn when working in proximity to electrical conductors. Face and eye protection shall comply with ANSI Z87.1. Chain saw-resistant leg protection shall be worn while operating a chain saw during ground operations. When noise levels exceed acceptable standards, as established by Federal regulations, approved hearing protection shall be provided by the employer and worn.

Effective means for controlling pedestrian and vehicular traffic shall be instituted on every job site where necessary in accordance with U.S. DOT Manual on Uniform Traffic Control Devices (MUTCD), or applicable state and local laws and regulations.

All overhead and underground electrical conductors and all communication wires and cables shall be considered to be energized with potentially fatal voltages. Only qualified line-clearance tree experts or qualified line-clearance tree expert trainees shall be assigned to work where an electrical hazard exists. Qualified line-clearance tree expert trainees shall be under the direct supervision of qualified line-clearance tree expert.

An electrical hazard exists when a worker, tool, tree, or any other conductive object is closer than ten feet from an energized electrical conductor rated 50 kV, phase-to-phase, or less. Direct contact is made when any part of the body contacts an energized line. Indirect contact occurs when any part of the body touches a conductive object that is in contact with an energized line. Conductive objects include a saw, tree branch, or another person. Even in an insulated bucket truck indirect contact can be made. Arborists and other workers shall be instructed that insulated aerial buckets do not protect them from other electrical paths to the ground, such as paths through trees or guy wires or from phase-to-phase contact. Arborist and other workers shall be instructed that electrical shock may occur as a result of ground fault when a person stands near a grounded object. Branches contacting an energized electrical conductor shall be removed using nonconductive equipment.



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When climbing a tree, the tie-in position should be above the work area and located in such a way that a slip would swing the tree expert away from any energized electrical conductor or other identified hazard.

Footwear, including lineman's overshoes, having electrical-resistant soles, shall not be considered as providing any measure of safety from electrical hazards. Rubber gloves, with or without leather or other protective covering, shall not be considered as providing any measure of safety from electrical hazards.

Qualified line-clearance tree experts and qualified line-clearance tree expert trainees performing line clearance in the aftermath of a storm or under similar conditions shall be trained in the special hazards associated with this type of work.

Aerial devices shall be provided with a point of attachment to secure a full body harness with a shock-absorbing lanyard or body-belt and lanyard. Fall protection shall be worn when working aloft.

Aerial devices shall not be used as cranes or hoists to lift or lower materials, unless specifically designed by the manufacturer to perform such operations. Wheel chocks shall be set before using an aerial device, unless the device has no wheels on the ground or is designed for use without chocks. The keys shall be removed from the ignition when vehicles and equipment are left unattended. No part of the boom or bucket shall make contact with energized electrical conductors, poles, trees or similar objects.

Brush chippers, trailer chippers, and towable stump cutters or stump cutter trailers, when detached from the vehicle, shall be chocked or otherwise secured in place.

Brush chippers equipped with a mechanical infeed system shall have a quick stop and reversing device on the in-feed system, which shall be:

- close to the feed end of the in-feed hopper;
- located across the top and along each side of the in-feed hopper;
- within easy reach of the worker.

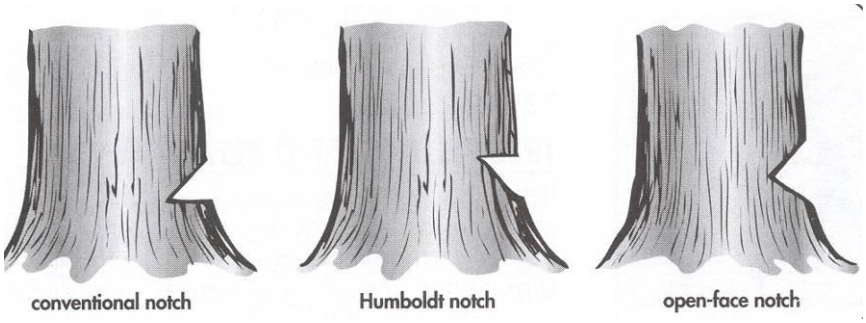
Vision, hearing and/or other appropriate personal protective equipment shall be worn when in the immediate area of a brush chipper in accordance with ANSI Z133.1 standards.

ANSI Z133.1 standards require that when a chain saw is being started, it shall be held firmly in place on the ground or otherwise supported in a manner that minimizes movement of the saw when the starter handle is pulled. The chain saw shall be started with the chain brake engaged. Drop-starting a chain saw is prohibited. Chain saw safety devices may not be removed or modified and shall be operational.

The kickback zone of a chainsaw is the front upper quadrant. Kickback happens while, in making a cut, the top of the bar nose contacts a solid object or is pinched. This causes the guide bar to fly back towards you. Kickback occurs at a rate twice as fast as a human can react.

The direction of safe retreat when felling a tree is 45 degrees from the sides and back on either side. NEVER move away directly behind the tree as you can be seriously hurt if the tree butt kicks back during the fall. Using a bore cut and a release cut will make it easier to retreat in plenty of time. Don't turn back on the falling tree. Walk quickly away to a distance of 20 feet or more from the falling tree and position yourself behind a standing tree if possible.

When manual tree felling, notches and back cuts shall be made at a height that enables the chain saw operator to safely begin the cut, control the tree or trunk, and have freedom of movement toward a retreat/escape path. The notch cut used shall be a conventional notch, an open-face notch, or a Humboldt notch. Notches shall be used for felling all trees over 5 inches diameter at breast height.



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A conventional notch is a directional felling cut into the side of a tree, facing the intended direction of fall and consisting of a horizontal face cut and an angle cut above it, creating a notch of approximately 45 degrees. A Humboldt notch is a directional felling cut facing the direction of fall and consisting of a horizontal face cut and an angled cut below it. A Humboldt cut is usually reserved for larger trees on steep slopes. An open-faced notch is a directional felling cut facing the intended direction of fall and consisting of two angled cuts creating a notch

greater than 70 degrees. Be sure that the notch depth does not exceed 1/3 the diameter of the tree and that the back cut does not penetrate into the predetermined hinge area.

When limbing and bucking, the tree expert must stand on the uphill side of the work. Whenever possible, cut limbs on the opposite side of the tree trunk from which you are working. Doing so keeps the tree trunk between you and the saw. Wedges should be used as necessary to prevent binding of the guide bar or chain when bucking up trunks of trees.

When a tree expert or arborist is working in a tree other than from an aerial device, chain saws weighing more than 15 pounds service weight shall be secured from falling by a separate line or tool lanyard.

Before climbing any tree:

- Inspect the tree and site for potential hazards;
- Understand the objective for the climbing job;
- Wear PPE (Personal Protective Equipment) and clothing suitable for work condition and weather;
- Do not wear jewelry;
- Follow safety standards;
- Take precautions and use caution.

Tree Experts and arborists shall have three points of contact with the tree and a minimum of two means of being secured while working aloft. Carabiners used as part of a climber's work-positioning (suspension) system shall be self-closing and self-double-locking and shall have a gate-locking mechanism that requires at least two consecutive, deliberate actions to unlock.

Snap hooks (rope snaps) used as part of a climber's work-positioning (suspension) system shall be self-closing and self-locking, with a minimum tensile strength of 5,000 pounds.

A stopper knot shall be tied in the end of the arborist's climbing line to prevent pulling the rope through the climbing hitch, when working at heights greater than one-half the length of the arborist's climbing line.

A hitch is a knot used to secure a rope to an object, another rope, or the standing part of the same rope. A climbing hitch is used for securing a climber to the climbing line, permitting controlled ascent, descent and working position. Tautline, Blake's, and Prusik hitches are examples of climbing hitches.

The secured footlock is a method used to climb a suspended rope. A Prusik loop, fashioned with an acceptable friction hitch, shall be used by the climber when footlocking.

Friction hitches are used for safety in ascent, work positioning and descending. The Blake's hitch, Kleimheist knot, Prusik knot, and tautline hitch are examples.

The clove hitch, Girth hitch, sheet bend and timber hitch are examples of attachment knots. Limbs and branches can be lowered by using the clove hitch. Tree Experts and arborists should be above or to the side of the limb being lowered when large limbs are lowered in sections.

The bowline, anchor, and buntline hitches are used as end-line knots to hold on to something.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Tree Support and Lightning Protection

Version 5.1

Prior to installation of any support system, objectives shall be clearly defined (i.e., provide supplemental support to co-dominant limbs; provide supplemental support to overextended branch; etc.). All necessary pruning should be performed prior to installing a tree supplemental support system. Pruning shall be done in accordance with ANSI A300 Part 1-*Pruning*. Once a cabling system is properly installed, it needs to be periodically inspected. Prior to installation, the owner of the tree or other responsible party should be notified that such inspections will be needed, and that they shall be the responsibility of the tree owner. Items requiring inspection include the system condition, position, and cable tension, as well as the tree's structural integrity. As the tree grows and changes over time, the system may need to be replaced, relocated, or maintained in order to stay functional. If existing cables need to be replaced. they shall not be removed until the new system is installed. They may be holding parts of the tree together and whole or partial tree failure could result if the existing support is removed before the new one is installed.

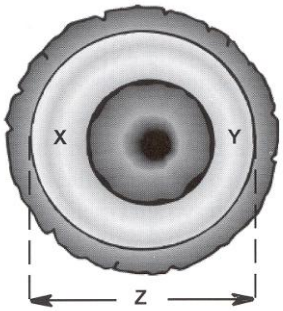
When drilling holes for hardware installation, the hole for lag-thread (wood screw type threads) hardware shall be slightly smaller (1/16 inch to 1/8 inch) than the diameter of the lag as you want the threads to bite into the wood for attachment. When using threaded steel rods or eye bolts (machine screw type threads), the drill hole should be slightly larger (no more than 1/8 inch) than the hardware as this type of hardware should pass through the hole unobstructed and be attached by nuts and washers at the ends.

A system is only as strong as the weakest component. Cabling systems should be designed so that system components (anchors, cables, etc.) have compatible working loads.

There are two types of brace rod installations, through braces and dead-end braces. Through rods go entirely through the tree and are fastened at both ends with washers and nuts. Rods used for through bracing are machine-threaded or lag-threaded rod steel. Heavy-duty washers and nuts are used to fasten each end of the rod.

Through-braces shall be used when bracing through decayed wood, weak wood, or in trees that are poor compartmentalizers. Anchors and braces shall not be installed in decayed areas where sound wood is less than 30% of the trunk or branch diameter.

Dead-end braces go entirely through the smaller of the two leaders and at least halfway into the larger leader. The rod used for dead-end braces is lag threaded to hold the wood without nuts. Dead-end braces cannot be used if decay is present in the path of the rod, or if the tree is a poor compartmentalizer of has weak wood. Lag hooks are also not considered safe in soft wood and decayed wood.



Symbol key for equation
X = sound wood depth, working side
Y = sound wood depth, opposite side
Z = total trunk (or branch) diameter; bark diameter not included

Equation for percentage of sound wood for through-bolt applications:
$[(X + Y) \div Z] \times 100 =$ % of sound wood for through-bolt applications

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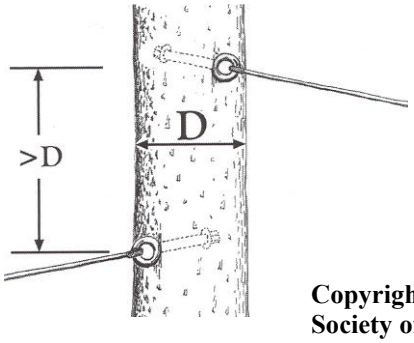

Longitudinal alignment of anchors and/or braces should be avoided. Holes should not be drilled closer together than the diameter of the branch or trunk being drilled or 12 inches, whichever is less. The diameter of the hole shall not be greater than one-sixth (1/6) the diameter of the limb, trunk, or branch at the point of installation.

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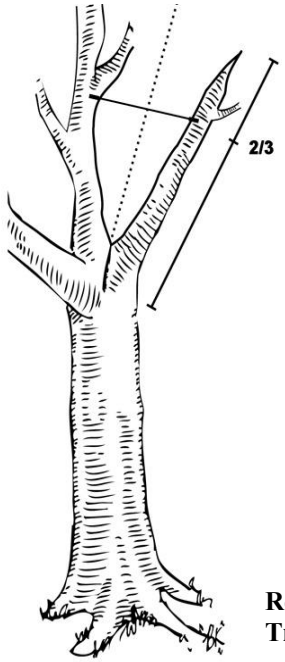

The proper ratio of cables to anchors is 1:1. Do not attach more than one cable to an anchor. Anchors for cables should be installed at approximately 2/3rds of the length/height of the limb to be supported (starting at the crotch or trunk, go 2/3rds of the distance to the branch tip).

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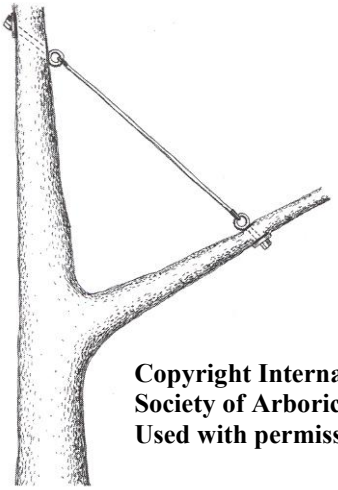
Anchor(s) shall be installed in alignment with the cable and termination hardware because as the angle of pull varies from 0 degrees (the cable moves away from a direct alignment with the hardware), the strength of the anchor decreases. A turnbuckle (a drop-forged, closed-eye device) can also be used for adjusting tension. These are important as the cables should be taut following installation. When installing support system hardware, washers shall not be countersunk into the wood.



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Thimbles are used to attach cables to the anchoring hardware. A thimble is used to protect the cable from excessive wear. Dead-end grip terminations shall incorporate extra heavy-duty wire rope thimbles – Type III, that meet the performance specifications of federal standard FF-T276b. Heavy-duty thimbles must be used with extra-high-strength cable.

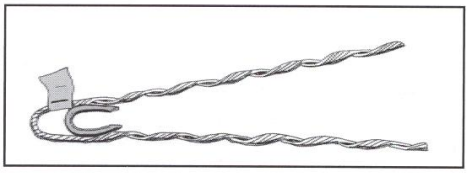

Figure 16. A thimble must be installed when using a dead-end grip.

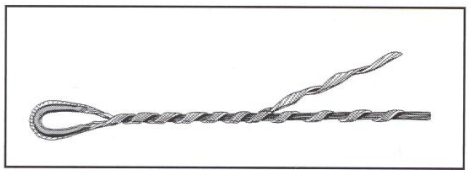

Figure 17. Dead-end grips are installed on the cable by wrapping the short leg of the grip around the cable, then wrapping the long leg. Both legs must be wrapped completely.

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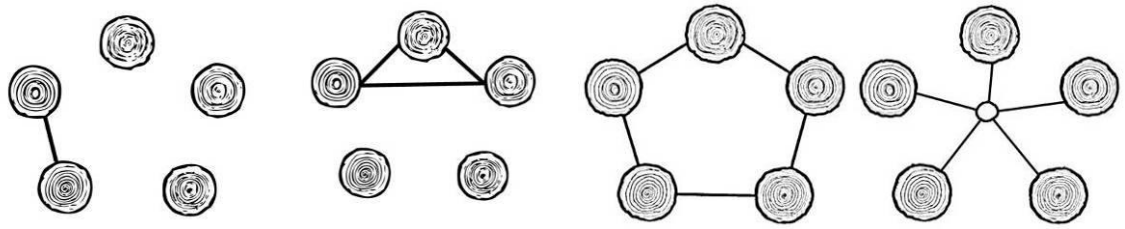
There are four primary types of cabling systems. A cable system involving a single cable between two branches of approximately equal size is referred to as direct cabling. When maximum support is required, the preferred system of cabling is triangular, which consists of connecting three tree parts in combinations of threes. Box cabling connects four or more tree parts in a closed system, and should only be used when minimal support is needed. Hub and Spoke cabling systems (all cables are connected to a central hub rather than to other trunks or branches) should only be used when other installation techniques cannot be installed.



Direct Triangular Box Hub & Spoke

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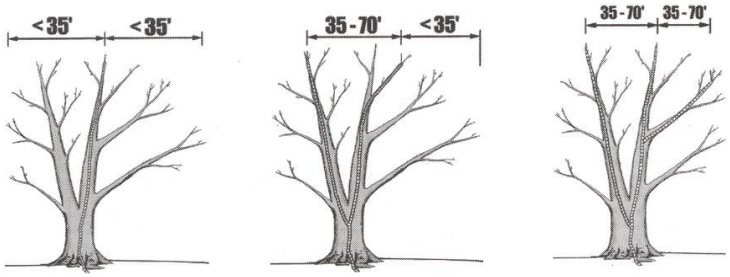
Bracing is normally used in conjunction with, rather than instead of, cabling. The preferred location for a single rod for a non-split crotch should be one to two times the branch diameter above the crotch. A large split or weak crotch normally requires two or more rods to hold the two sections together and minimize twisting.

When tree-to-tree guying, anchor trees shall be inspected for structural integrity, have the ability to meet the objective, and be attached in their lower half to the upper half of the tree needing support. Ground anchor(s) should be placed no closer to the trunk than 2/3rds the distance from the ground to the height of the lowest point of attachment in the tree.

Prior to installation of a lightning protection system, the owner or owner's agent should be notified of the need for periodic inspection of the system. Inspections are the responsibility of the tree owner, and should include the system's condition, position, and grounding integrity.

The uppermost point of a lightning protection system, intended to intercept lightning strikes, is the air terminal. Tree lightning protection systems may be terminated with or without manufactured air terminals or "points." If manufactured air terminals are used, blunt terminals are better receptors than sharp terminals.

Only one primary conductor is required, even on large-diameter trees. However, if the tree is wide spreading, additional branch conductors should be installed. Branch conductors connect all other air terminals to the primary conductor. Branch conductors should be installed on large branches so that no aerial portion of the tree is farther than 35 feet from a conductor. Cable splicers or clamp-type (multi-use) connectors shall be used to form end-to-end, side-by-side, or Y splices in conductors. The conductors shall be at least 14 strands of 17 AWG copper wire.



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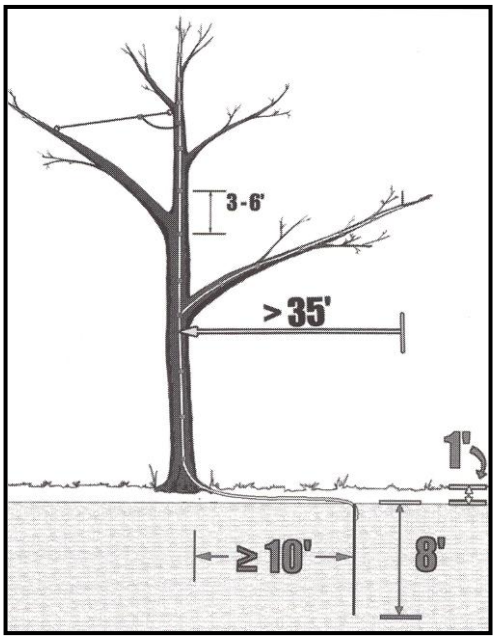

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When installing lightning protection systems, conductors shall be fastened to the trees with drive fasteners, installed at intervals of no more than six feet. If a tree with a lightning protection has also been cabled, the cables should be connected to the lightning protection system by a bronze or bimetallic clamp-type lamp that form an electrolytic couple.

Ground terminal installation should not damage roots greater than two inches in diameter. When using a single ground rod system, the ground conductor shall be installed in the soil at a minimum depth of eight inches and at least ten feet away from the trunk. The ground terminal rod (at least 8 feet long) shall extend into the earth to a minimum depth of nine feet.

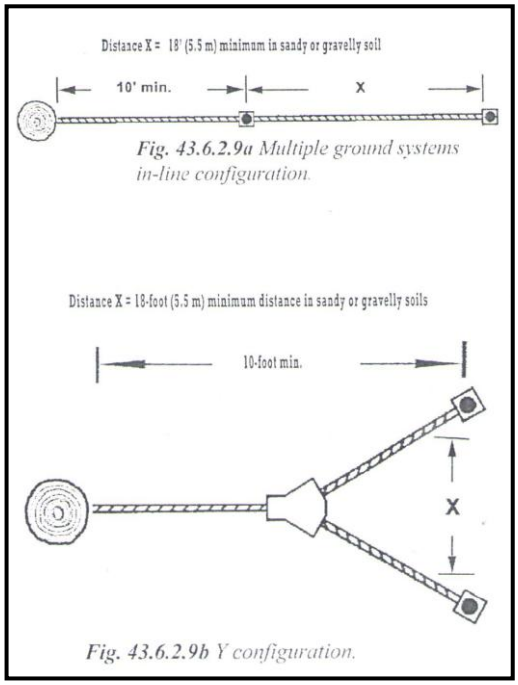
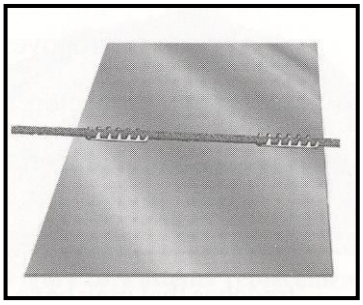


Fig. 43.6.2.9a Multiple ground systems in-line configuration.

Fig. 43.6.2.9b Y configuration.

Multiple grounding systems shall be used when the full length of the ground rod cannot be driven into the soil. When using ground rods as in-line or Y configurations in sandy or gravelly soils, the rods shall be located a minimum distance of 18 feet from each other and 10 feet from the tree.

Horizontal ground systems should be preferred when ground rods cannot be driven at least two feet into the soil. Horizontal systems should terminate with a ground plate installed eight inches or deeper below the soil surface if conditions allow. Conductors shall be installed in trenches extending away from the tree at least 24 feet in sandy or gravelly soil and 12 feet in other soils.



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Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Construction Management

Version 5.1

Loss of forest cover in Maryland occurs primarily as a result of increased development and urbanization. Construction damage is one of the greatest causes of tree death and decline in urban areas.

Development impacts can damage trees directly by severing roots, severing branches, and compacting the soil. The most serious damage caused by construction occurs underground from construction activities that cause soil compaction and root damage. Most of a tree's absorbing roots are in the upper few inches of soil. Their ability to absorb oxygen, water and minerals is reduced when soil is compacted and the pore space between soil particles is greatly reduced.

An effective initial step is to perform a **tree resource evaluation** which is completed during the project's planning phase. The trees within the project area and adjacent areas encroaching on the project area should be included based on defined criteria, such as species, size, condition, spacing, and structure. This evaluation can be a survey or an inventory. A survey is a description of all trees based on a representative sample, compared to an inventory which is a comprehensive listing of individual trees. This evaluation is a document describing the tree resources present with information that includes tree species, location, condition, plant community, structure, health, and population estimate. A Tree Expert, arborist, or other qualified professional shall complete the tree resource evaluation. Trees included in the resource evaluation should be assigned suitability for conservation ratings:

- Good = good health, structural stability, and potential for longevity at the site;
- Moderate = fair health, moderate structural defects, and require more intense management;
- Poor = poor health, significant structural defects, and are expected to decline regardless of management.

Factors to consider when evaluating a tree's suitability for conservation include tree health, structural integrity, species response to construction impacts, and tree age and longevity.

A **tree management report** shall be developed during the design phase of the project and should include an evaluation of the impacts on trees and shrubs from the proposed site development and construction activity. This tree management report should include an evaluation of the impacts on trees and shrubs from proposed side development and construction. The report should include tree locations, description of the applicable tree population, suitability for conservation ratings, limits of construction, an evaluation of impacts to the trees, proximity

of trees to existing and proposed features, recommendations for retention or removal of individual trees, recommendations for design changes if needed to preserve trees, tree conservation specifications, and post-construction recommendations.

A **tree conservation plan** should also be developed during the design phase of the project and integrated with the site development plan. This plan should include the locations of trees to be preserved, tree protection zones and barriers, soil erosion controls, staging and storage areas, existing and proposed utilities, and other on-site activities. The plan should also include consequences for non-compliance. Implementation of tree protection specifications should be monitored by an arborist.

Trees scheduled for retention should not be damaged during tree removal during the pre-construction phase. Tree protection zone barriers shall be installed prior to site clearing, grading and demolition, and maintained through construction and landscaping. Specifications for barriers should include, but are not limited to, the type of fencing, use of other barriers (i.e. signs), manner of installation, and conditions for encroachment into the critical root zone (tree protection zone).

During the construction phase of a project, the tree expert or arborist should monitor tree health and compliance with tree protection zones. The arborist should communicate the tree specifications during a pre-construction meeting to all persons involved in the development process. Levels of compliance with tree protection specifications and goals should be documented and reported. Some symptoms and signs of construction damage include:

- Crown - Slow rate of growth, staghorns, or dieback;
- Leaves - Wilted, scorched, sparse, undersized, distorted, chlorotic, browning leaf margins, premature autumn color, or premature leaf drop;
- Trunk - Wounds, bark removed, crown rot, absence of buttress flares, adventitious sprouting, suckering, and severe insect damage and disease;
- Branches - Dieback, slow growth rate, wounds, adventitious sprouting, or suckering;
- Fruits and flowers - Abnormally large crop or absence of fruit or flowering out of season.

In the event of damage to tree protection zone barriers and/or trees within them, corrective measures should be specified and implemented. Treatment of damaged trees should begin when the damage occurs. If a significant portion of the root system is destroyed, then the remaining root system should be pampered. Mulch it to hold soil moisture, moderate temperature extremes, and remove competition from turf grasses and weeds. Regular irrigation is most effective because trees that do not become moisture stressed have better a survival rate. Maintain the tree's vitality to avoid stress and infestation of insects and diseases. If fertilizer with nitrogen is needed, use slow-release form after period of recovery.

The critical root zone is the minimum volume of roots necessary for maintenance of tree health and stability. The Critical Root Zone of a specimen tree (30 inches diameter at breast

height or greater) is a circle with a radial distance of 1.5 feet for every 1 inch dbh. The Critical Root Zone of a nonspecimen tree (less than 30 inches dbh) is a circle with a radial distance of 1.0 foot for every 1 inch dbh with a minimum of eight feet.

If few to no roots over one inch in diameter will be impacted by construction activity, the tree will probably tolerate the impact. Most healthy trees are able to tolerate removal of one-half of their absorbing roots (not structural roots) without serious effect. According to ANSI A300, tree protection devices such as fencing, berms, and signage can be installed prior to site work to limit access to critical root zones.

For temporary traffic over the root zone, use vertical mulching and then place 6-12 inches of mulch to disperse the weight of equipment. When construction is finished, half of the depth can be removed and spread out over the area under the drip line as mulch.

Sometimes aeration systems are installed to help preserve trees, although there is little research to confirm the value of these systems.

When the grade is lowered during construction activity, it is referred to as a cut. Changes in grade can affect root volume, aeration, and drainage. If the grade is raised, it is referred to as fill and roots may be suffocated. As little as four inches of fill can kill some species. Tree wells and retaining walls are scheduled for installation during the construction process to allow tree retention when changes in grade are required.

If a condition is observed requiring attention beyond the original scope of work, the condition shall be reported to an immediate supervisor, the owner, or the person responsible for authorizing the work.

It is commonly thought that a healthy tree can tolerate removal of approximately 1/3 of its total root mass. Trenching can severely injure a tree. Instead, auger under the roots. Tunneling may be used instead of trenching to minimize impacts to a trees critical root zone. Minimum depth should be 24 inches to avoid damage to any tap roots that may be present. Pruning roots prior to construction can help avoid impacts to the critical root zone. Roots should be cleanly cut using a vibratory knife or other acceptable equipment. Backfill the trench with soil to minimize drying of the roots.

Retained trees located along the Limits of Disturbance (LOD) should be evaluated for susceptibility to windthrow. Interior forest trees are now exposed to the wind as edge trees. They may not have developed a strong root system as they grew and were protected by the other forest trees.

Maryland Licensed Tree Expert Exam Study Guide

For Exam Domain:

Tree Identification

Version 5.1

The Tree Identification portion of the test shall consist of the identification of fourteen (14) trees using photographs. All questions will be multiple choice. The fourteen (14) trees on the exam will be drawn from the following list:

GENUS	SPECIES	COMMON NAME
Acer	*Negundo*	Boxelder
Acer	*Rubrum*	Red Maple
Acer	*Saccharinum*	Silver Maple
Ailanthus	*Altissima*	Tree of Heaven
Betula	*Nigra*	River Birch
Cornus	*Florida*	Flowering Dogwood
Cornus	*Kousa*	Kousa Dogwood
Fagus	*Grandifolia*	American Beech
Fraxinus	*Americana*	White Ash
Gleditsia	*Triacanthos*	Honeylocust
Ilex	*Opaca*	American Holly
Juglans	*Nigra*	Black Walnut
Liquidamber	*Styraciflua*	Sweetgum
Liriodendron	*Tulipifera*	Tulip Tree
Magnolia	*Stellata*	Star Magnolia
Malus	*Species*	Crabapple
Paulownia	*Tomentosa*	Royal Paulownia
Pinus	*Strobus*	Eastern White Pine
Platanus	*Occidentalis*	American Sycamore
Prunus	*Yedoensis*	Yoshino Flowering Cherry
Quercus	*Alba*	White Oak
Tilia	*Cordata*	Littleleaf Linden
Tsuga	*Canadensis*	Eastern Hemlock
Ulmus	*Americana*	American Elm