RIGHT PLANT/RIGHT PLACE
SITE ANALYSIS AND PLANTING

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INTRODUCTION

Long-term healthy plants rely on a thorough understanding of historical and existing site conditions that inform plant species selection. In addition, nursery stock factors, site preparation and planting, and ongoing maintenance play key roles in establishing healthy plants on the front end. This chapter focuses on how to assess plant-related conditions, but should be noted that in the design process, project site selection generally occurs before plant selection. Therefore, as a plant professional you may be asked to put plants in locations or with conditions that are not conducive to long-term plant health. You have a responsibility to address any site conditions that may impact sustaining healthy plants or the environmental or cultural systems that plants depend upon.

SITE CONSIDERATIONS FOR SUSTAINABLE PLANT HEALTH

Site analysis is the process of gathering information and assessing its constraints and opportunities on plant selection and the design of planting spaces. Simply said, you need to understand the relationship between plant species' needs and project site characteristics. The information commonly inventoried is described below in two categories, biophysical and cultural aspects. This list is not exhaustive, and should be project specific. Working with existing site conditions whenever possible, rather than modifying them, reduces costs and environmental impacts.

Biophysical Characteristics

Soils
Soil is the foundation of life on earth. Plants rely on soil, or a growing medium, for water, air, nutrients, and root structure. Good soil is slow to form and should be protected and minimally disturbed. In addition, soils with undesirable traits should be improved. The first activity is to identify soil type and quality through tests for traits such as texture, type, compaction, percolation, and nutrient availability for multiple locations around a project site. Soil characteristics vary based on microclimate factors at the site-scale. Understanding soil in all planting locations is necessary, rather than simply a catchall approach or utilizing a NRCS Soil Survey, which should only be applied at a much larger mapping scale. Assessment questions include, where has soil been disturbed and how, where are soils healthy and should be protected, and where are soils degraded or absent and how can they be restored? Some of the key soil traits for plant selection are discussed below.

pH is a measure of soil acidity or alkalinity, ranging from 0-14 (pH of 7 is neutral; pH between 7-14 is alkaline; pH between 0-7 is acidic). Typical soil levels are between 4-9, with disturbed, urban soils typically above 7. Soil chemistry is complex, and many factors influence pH. Plants are adapted to growing in soils with particular pH levels, and therefore, it is essential to align plant selection with soil pH. Some plants are adapted to a wide range of pH while others require a narrow range. Soil pH also relates to nutrient availability, and plant nutrients are sufficiently available for most plants when pH is within 6.0-7.5. Soil pH can be modified slightly, but over time it generally returns to its original pH. Soil pH can be increased by applying carbonate or lime, while decreased by adding organic matter or sulphur. Some trees that can tolerate alkaline soils include hackberry, honeylocust, ponderosa pine, and blue spruce. However, in general, evergreens prefer slightly acidic soils.

Soils contain nutrients essential for plant growth. Macronutrients are required in significant quantities, while micronutrients are only required in trace amounts. Macronutrients include nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium. Micronutrients include iron, manganese, copper, zinc, molybdenum, boron, and chlorine. When soil chemistry tests do show nutrient deficiencies, it is important to analyze its cause. Imbalances in plant-available nutrients can affect plant functions including plant growth, vigor, leaf color, disease or insect resistance. In general, healthy soils with sufficient organic matter content will support the nutrients most plants need. Stable composts can be added to supply a slow release of nitrogen; ideally amended into soil before planting occurs to a depth of 12-18."

Soil drainage and water-holding capacity are impacted by texture, structure, compaction level, and slope. A lack of good drainage reduces oxygen movement in soils needed for root functions. Assessing percolation rates, how quickly a site drains, is essential when choosing plants that will thrive in wet (poorly-drained) or dry (fast-draining) soil conditions. For example, a basin designed to infiltrate rainwater utilizes plants that can withstand water inundation at the bottom of the basin and plants that prefer drier soil conditions on the upland slopes. Generally, sandy soils are well drained and clay soils are poorly drained. Plant species adapted to wetland conditions, such as willows and alders, tolerate poorly drained or aerated soils. Where faster percolation is desired, soils can be amended with sand, rock, or mulch. Also, if soil replacement or augmenting is required for a specialized site, like a rain garden or drought-tolerant garden, soil components to meet drainage requirements can be mixed by suppliers with specified percentages before delivery to the project site.

Common characteristics of urban soils include grade changes caused by cut and fill, compaction, loss of stability, impervious crust, altered soil pH, poor drainage caused by compaction, nutrient deficiencies, human materials like rubble and debris, and small soil volumes inadequate for plant growth. The presence and severity of these conditions should be analyzed for all project sites. Oversight of plant and soil protection measures prior to and during construction is advised to minimize disturbance and ensure preservation. Degraded soil quality is common around building foundations, parking lots, or other large construction sites because topsoil is removed and stockpiled, and replacement soil is lower quality. Topsoil, rich in organic matter and nutrients, is often mixed with subsoil and becomes degraded. Soil compaction is extremely common due to heavy construction vehicles, equipment, and materials storage. Site preparation and design strategies to improve available soil volumes to support plant growth should be considered. Rehabilitation strategies include deep de-compaction to depths up to 48” and subsoiling where organic material is incorporated into lower horizons. Structural soils and suspended pavement systems (structural cells), which have properties to both support tree growth below ground and the strength requirements of streets, curbs, and sidewalks above ground, can be used to increase the soil volume to support plant growth to maturity.

Slope

A slope analysis is important to understand existing drainage patterns and areas of steepness or significant grade changes. For larger project sites, or a project with applicable stormwater management regulations, a complete topographic survey performed by a contracted surveyor is likely required. Low spots or depressions can collect water, and areas with gradual slopes will not drain as quickly. Areas with steeper slopes drain water quicker and may experience drier conditions at the top of the slope, hill, or berm; specific selection should be designed accordingly. Changing the natural soil depth around existing vegetation, especially trees, is not advised. When grading soil to create naturalistic slopes, a 33% maximum slope should be used to successfully establish plants, minimize erosion, and operate landscape maintenance equipment safely. Maximum landscape slopes are also often regulated by development codes. Planting strategies, such as live stakes and live fascine bundles, can be used in combination with other slope stabilization strategies.

Water

Water is essential for plant growth, and the amount required for plant growth varies by species, season, soils, microclimate, and plant maturity. Water is a finite natural resource, and ensuring healthy water quality and quantity should be of upmost responsibility. Water sources that should be inventoried on a project site include surface waters, ground water, precipitation, and irrigation sources and systems. Rainwater, especially as runoff from impervious surfaces, should be directed toward plantings or depressions to utilize for plant growth or to mimic natural drainage patterns and groundwater recharge. Understanding the watershed-scale challenges that the project site contributes to is also important to plant selection and water use in the urban landscape. For example, a project set within a watershed where available water resources are at risk, should prioritize selection of species that will required less to no supplementary watering beyond natural precipitation after establishment. Utilizing irrigation systems and management plans that adapt to site conditions and climate is essential to responsible water use. Providing adequate water during the plant establishment period, typically 2-3 years, is essential for long term health of all plantings, even drought-tolerant. Irrigation system components that improve water efficiency, like low-flow emitters, drip lines, smart controllers, and rain gauges, should be utilized whenever possible. In addition, simple adjustments to irrigation timing and settings can save water, by reducing evapotranspiration rates, and improve plant growth.

Vegetation

All existing vegetation should be observed to understand its condition, function, and aesthetic value. Typical traits to inventory include species, size or square foot coverage, health, and attributes that are working well or should be

addressed. Vegetation to preserve and appropriately protect during construction activities should be noted and monitored during any construction activities. Also, plants that create a hazard, are invasive, or will not survive should be noted for removal. Finally, the site should be analyzed for areas that would benefit from an increase in vegetative cover or structure.

Climate

Solar access, wind, and temperature conditions should be inventoried to identify varying microclimates that occur throughout the project site. Other site conditions impact microclimates. For example, planting areas around building foundations are typically warmer and more protected. A sun-shade study should be completed for all planting areas. Typical categories are full-sun (6+ hours direct sun/day), part-sun (4-6 hours sun/day), part-shade (2-4 hours sun/day), and full shade (less than 2 hours sun/day). Most plants require sunlight to fuel photosynthesis. Each plant species thrives within a range of solar conditions. Generally, plants native to the understory tolerate low light conditions best. In arid climates or where there is infrequent cloud cover, desiccation and sunscald are common. Under these circumstances, species that typically prefer full sun conditions may thrive in part-sun or part-shade. Site locations where climate modification is desired should be assessed. For example, a sunny area is desired for planting edibles, whereas shading is desired for west-facing windows. Wind impacts humidity and soil moisture. Areas that receive heavy winds are more at risk for dry soil conditions, loss of plant moisture, and damage to branches and overall form. Generally, drought-tolerant species are also wind tolerant. Planted windbreaks can be designed, especially on the larger site-scale, for energy conservation or site experience for people using the site.

Cultural-Related Characteristics

Property Boundaries

Property boundaries, easements, or setbacks should be mapped or professionally surveyed. All plantings and associated work needs to occur within the property lines. Streets or building sites with easements for future expansion are likely unsustainable locations for new trees.

Policies

Researching all regulations, ordinances, or permitting that apply to the project site is necessary to understand requirements for design and planting. Common policies related to plants include permitted tree species for public sites, invasive species not permitted, mature height restrictions under overhead utility lines, minimum tree DBH sizes or plant communities required to protect, and street tree spacing. Regulations may apply at multiple jurisdiction levels (local, state, federal).

Site Uses

The existing site uses or activities should be inventoried to understand their beneficial relationships with or constraints on proposed plantings. These uses include permanent and temporary structures, driveways, walkways, patios and other paved surfaces, recreational activities, or other uses that may impact plant health and structure. For example, the area used to stage heavy construction machinery leads to very compacted soils and would require special site preparation to support plant health. Or, in a residential setting the available area between the driveway, sidewalk, and the front porch may not be enough space to support a large shade or evergreen tree.

Utilities

All above and below ground utilities should be located prior to site design, plant selection, and installation. These include power lines, sanitary sewer, water, stormwater, electrical, and fiber optic. Plant species should be thoughtfully selected for sites that are underneath, on top of, and adjacent to utilities to promote mature and healthy growth. Planting medium to large trees underneath utility lines will only result in prolonged topping. Therefore, small to medium or ornamental trees should be selected in these cases. In addition, adequate space for root growth in addition to utility access should be considered when planting near underground utilities.

Sight Lines

The site should be assessed for desirable views, undesirable views, and areas to keep clear of vegetation for site safety, like sight lines at intersections. Evergreen plants and densely-branched shrubs are often used for obstructing or diffusing undesirable views. Plants in rows or with large openings, along with other site elements like pergolas or gates, are used to frame desirable views. When using plants to screen or obstruct in urban landscapes, site safety should be considered. High, dense, or enclosed vegetation may unintentionally create spaces that feel unsafe.

Operations-Related

Conditions to inventory include maintenance access locations, equipment or vehicle sizes, snow storage areas, and paved areas with heavy deicers application. Planting locations should not interfere with snow removal equipment and dumping, and should accommodate room for maintenance access and equipment.

Human Health & Well-Being

The existing human experience of the site should be observed and assessed. There is a plethora of research the supports positive connections between plants and human health, like decreasing depression and anxiety, increasing cognitive abilities, and improving physical health. Plants contribute to a site's sensory experience through noise, scent, and touch. Opportunities for plants to provide play, respite, or interactive elements should be considered. For example, a grove of trees may provide shade for picnic tables. Finally, assessing opportunities for interpretive signage is a way to provide information about planted species.

PLANT SPECIES SELECTION CONSIDERATIONS

Plant selection should be informed by both the existing site conditions as well as the design or planting goals (see Ch. # Landscape Design). Many of the considerations for plant selection were mentioned section 2. Below, additional detail as well as new content is discussed. Remember, a plant's ability to thrive depends on a variety of factors, and these factors vary across a project site and over a plant's life. Critical analysis and careful attention to these factors are key to a choosing appropriate species, however, adaptable plant care and site maintenance are also important elements for sustained plant health and its benefits.

Plant Hardiness

One of the first considerations when selecting a plant should be its cold hardiness. Woody plants have been classified into plant hardiness zones using a map system developed by the USDA (see References). The map's zones are based on the average annual minimum temperature a species is likely to survive. Montana USDA zones range from 3a-6a, with the most areas in zones 3-4. Zones 5-6 mostly occur in western Montana. The maps do not consider other site conditions that impact a plant's survivability, like length of growing season, snow coverage, soil characteristics, and sun intensity, so simply choosing a plant based only on hardiness zone is not enough. Some plants go through dormancy or take multiple season to germinate, and these growth characteristics are important to be aware of during plant establishment and care.

Nativity

Selecting native plants may offer complementary site design or planting goals such as providing habitat for birds and pollinators, using plants adapted to local soils and moisture conditions, and supporting native plant community regeneration. When using native plants, it is important to assess whether the project site conditions will be able to support native plant needs. Urban or disturbed project sites likely exhibit traits that are not native and may inhibit native plant health. For example, a healthy native prairie relies on plant genetic diversity and fire disturbances that are difficult to restore or mimic on urban project sites. Some projects require the use of native plants. Because many of the plants available in the nursery trade are native cultivars or non-native species, it may require working with a specialized grower. Native cultivars and non-native ornamental species are not necessarily invasive or problematic, and may exhibit more desirable environmental or aesthetic traits. For example, quicker or denser growth, uniformity, showier flowers, no self-seeding, and pests and disease resistance. Also, many cultivars have been bred for traits to better tolerate tough site conditions, making them excellent choices for urban and community planting sites.

Maturity & Growth Rate

Selecting plants with appropriate mature sizes is very important for plant health and aesthetics. Considerations for plant heights and utilities is discussed above. Placement of trees and large shrubs near buildings should be done in a way so there is enough space for mature widths and so that they do not block windows. A plant too large for the scale of the planting area quickly becomes overwhelming, both visually and functionally. Trees and shrubs should be spaced apart to avoid shared growing space, which leads to dye-out of branches or prolonged reduction pruning. It is often desirable to plant faster growing species to get more immediate benefits from shade, wind protection, etc., especially in climates with short growing seasons. However, these faster growing species are often more prone to insects, disease, and have weak wood, and heaving, suckering root systems that can create problems under pavement and with sewer and septic lines. Utilizing a combination of plants with diverse growth rates can provide plant benefits over both the short and long term.

Diversity

Plant diversity is advantageous for several reasons. Species diversity is important for growing resiliency against future disease and pest threats. Age and growth rate diversity provides more consistency of benefits as plants reach maturity and die. Size diversity allows plants to occupy varying horizontal and vertical spaces and create niche habitats. Plant diversity creates sustained aesthetic interest, through time and space.

Aesthetics & Site Users

Plant selection should also be informed by design principles, such as unity and scale, texture and emphasis (see Chapter 10). Different site users may impact plant selection. With pets and children, poisonous plants, plants with thorns or spikes, or some edible plants should be avoided. Plants with large falling fruits or prolific seeds production should be carefully placed in relation to ADA accessibility and maintenance considerations.

REFERENCES

Calkins, Meg, 2012. The Sustainable Sites Handbook: A Complete Guide to the Principles, Strategies, and Best Practices for Sustainable Landscapes. John Wiley & Sons, Inc.: Hoboken, NJ.

Hopper, Leonard J., 2007. Landscape Architectural Graphic Standards. John Wiley & Sons, Inc.: Hoboken, NJ.

LaGro, James A., Jr., 2013. Site Analysis: Informing Context-Sensitive and Sustainable Site Planning and Design (3rd Ed.). John Wiley & Sons, Inc.: Hoboken, NJ.

USDA Plant Hardiness Maps: http://planthardiness.ars.usda.gov/PHZMWeb/

Review

A. What are common characteristics of urban soil? Describe strategies for site preparations or plant selection that would mitigate potential challenges?

_____

_____

_____

B. How does slope impact plant selection?

_____

_____

C. What four water sources should be inventoried and assessed to inform design and plant selection?

1. _____ 2. _____

3. _____ 4. _____

D. When inventorying existing site vegetation, what information should be recorded?

_____

_____

E. How many hours of sun define the following categories? What plants do best in part- to full-shade?

Full Sun: _____ Part-Sun: _____

Part-Shade: _____ Full Shade: _____

F. List three cultural-related considerations during site analysis. Provide an example for how each impacts plant selection.

1. _____

2. _____

3. _____

G. What are potential benefits of plant species diversity?

_____

_____

H. List three problems commonly associated with very fast-growing tree species.

1. _____ 2. _____ 3. _____

I. What is the one environmental factor that hardiness zone maps are based upon?_____

J. What other factors are important in determining a plant's hardiness for a particular site that are not considered in the USDA Hardiness Zones?

_____

K. What cultural-related elements could impact tree planting locations around a parking lot?

_____

L. What are the macronutrients that plants need? _____

SELECTION OF NURSERY STOCK

American Standard for Nursery Stock

Standards for nursery stock are provided by the American Horticulture Industry Association (AmericanHort), which is an Approved American National Standards Institute (ANSI) accredited Standards Developing Organization. The Standard is an essential reference for anyone in the green industry who specifies, grows, distributes, buys, or installs nursery stock.

The purpose of the American Standard for Nursery Stock is to provide buyers and sellers of nursery stock with a common terminology in order to facilitate transactions involving nursery stock. The standards establish common techniques for measuring plants, specifying and stating the size of plants, determining the proper relationship between height and caliper, or height and width, and determining whether a root ball or container is large enough for a particular size plant.

Below are two sample Sections from the American Standard for Nursery Stock.

Section 1: General Standards

The following standards are applicable to all nursery stock, with exceptions and particular applications noted.

1.1 Required specifications

1.1.1 Plant size specification required

Specifications must include plant size, by caliper, height, or width, as appropriate to the plant type as set forth in the appropriate plant type section, except for certain perennials and non-winter-hardy shrubs, which may be specified by container class only (See Section 13 - herbaceous perennials, ornamental grasses, groundcovers, and vines, and Section 3.1.0 - Type 0 tender deciduous shrubs).

1.1.2 Plant size intervals

Plant size specifications should include only the minimum measurement of the desired plant size interval. The measurement so specified is the minimum size allowable and shall include plants from that minimum size up to but not including the minimum size in next larger size interval. Acceptable size intervals for each plant type are shown in the appropriate plant type section. For instance, a specification for a "2.5 in. cal." Type 1 shade tree references the "2.5 to 3 inch" caliper size interval, while a specification for a "5 ft." Type 4 spreading tree references the "5-6 ft." height size interval.

1.1.3 Container class specification required

Specifications for container grown nursery stock shall include a container class specification, in accordance with Table 1, below, in addition to the plant size specification. Containers marketed and sold that indicate a "trade" or "#" designation must have volumes within the ranges shown in Table 1 in order to comply with this standard.

3.3 Type 2 intermediate deciduous shrubs

3.3.1 Classification of Type 2 intermediate deciduous shrubs

Plants that typically mature at a height or spread from three feet up to seven feet.

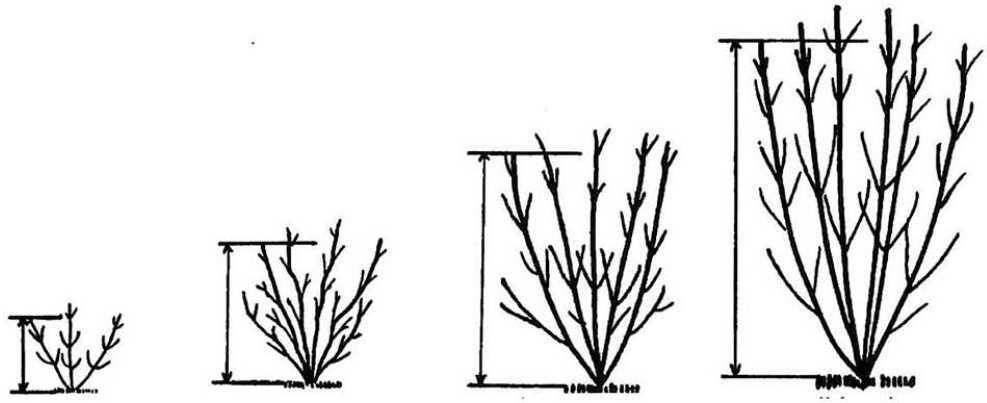
3.3.2 Specifications for Type 2 intermediate deciduous shrubs

Table 11 – Deciduous shrubs – Type 2 intermediate

Plant size specification indicates height, using three-inch intervals through 3-6", then six-inch intervals through 18-24", then one-foot intervals from 2-3' to 6'7'

Examples: *Azalea x (exbury, mollis hybrids), Chaenomeles japonica, Cornus sericea, Cotoneaster devaricata, Euonymus alata 'Compacta,' Fothergilla 'Mount Airy,' Lagerstroemia indica 'Victor,' Potentilla fruticosa, Spiraea x bumalda 'Froebelii,' S. nipponica 'Snowmound,' S. x vanhouttei, Viburnum carlesii, V. juddi, Weigela floribunda Wine & Roses, 'Vanicek,' W. florida 'Java Red'*

Height	Minimum number of canes	Minimum spread of roots or root ball diameter	Minimum root ball depth	Acceptable container classes	Minimum acceptable in-ground fabric bag size (diameter)
6 in.	3	6 in.	3 ⅞ in.	#SP4,#1	5 in.
12 in.	3	8 in.	5 ¼ in.	#1,#2	5 in.
18 in.	4	10 in.	6 ½ in.	#2,#3,#5	8 in.
2 ft.	4	12 in.	7 ¾ in.	#3,#5,#7	8 in.
3 ft.	5	14 in.	9 in.	#5,#7,#10	10 in.
4 ft.	5	18 in.	11 in.	#7,#10,#15	12 in.
5 ft.	6	24 in.	14 in.	#10,#15,#25	14 in.
6 ft.	6	30 in.	18 in.	#15,#25	16 in.



12" ht., 3 canes 2' ht., 4 canes 4' ht., 5 canes 6' ht., 6 canes

FIGURE 14 – Type 2 intermediate deciduous shrubs

Types of Nursery Stock

Balled-and-Burlapped
Plants grown in ground that have been dug so the soil immediately around the roots remains undisturbed. The ball of earth containing the roots is then bound up in burlap or similar mesh fabrics using twine, and may be placed within a wire basket. Balled-and-burlapped plants are generally the most expensive form of nursery stock and are relatively heavy, making handling and shipping difficult. These plants should only be handled by the root ball to prevent separating the roots from the soil.

Bare-Root
Plants harvested from nursery fields when dormant and with the soil removed from the roots. Bare-root plants must be stored under cool temperatures and high humidity to prevent desiccation and loss of dormancy, and the roots must be wrapped in a moisture-retaining material while being transported. There are many advantages to using bare-root plants, including lower cost, ease of transportation and planting, decreased need for watering during establishment, and none of the root deformation that can have lasting effects on container-grown plants. Due to having been dug and stored without soil on the roots, bare-root plants can exhibit reduced growth and fullness during the first year, however once established, often demonstrate superior landscape performance.

Container-Grown
Plant that have been grown to a specified size in a container. Container-grown plants have become a large percentage of nursery stock sales due to their longevity on sales lots without the need for specialized storage facilities or handling equipment. However, container-grown plants can be subject to problems not encountered with more traditional field-grown nursery stock.

Plants grown in standard plastic containers are prone to root deformations such as circling, descending and kinked roots resulting from contact with the container wall. If not corrected at planting, these misshapen roots can cause long-term problems, including poor landscape establishment, reduced anchorage, and decline resulting from girdling roots that constrict the trunk. A variety of "root-pruning" container designs have been developed in attempts to minimize root deformation during production. Containers that consistently perform best in studies of these new designs are made of polypropylene fabric, which greatly improve root architecture, increase fine root mass and improve transplantability.

Another potential problem with container-grown plants is rapid water loss following planting. Because container media is composed of coarse materials such as composted bark, peat and sand, it is subject to water loss via drainage and capillary action when planted into landscape soils that typically have much finer pore spaces. This drying can lead to water stress and slow establishment. Methods for managing these issues are addressed in the section on Planting below.

Containerized
Plants grown in a field, dug bare-root, and potted into a container. Containerized plants must be grown for a short period to establish roots into the media before transplanting, and should be planted within one year. Containerized plants can be subject to the same problems as container-grown plants if grown in the container for too long.

Plugs or Cones
Herbaceous plants grown in smaller specialized containers or cells that are typically sold by the rack. Plugs or cone plants are regularly used in naturalized or restoration plantings where using seed is not feasible or takes too long to establish. Plugs or cones are also more economical than container-grown plants, especially for large projects.

Processed-Balled
Processed-balled plants are field-grown, dug bare root, and a growing medium is formed around the roots to produce a ball that is then wrapped in burlap and twine. Like containerized plants, processed-balled plants should be grown for a short period to establish roots into the media before transplanting, and should be planted within one year.

Field-Potted, Field Boxed or Balled-and-Potted
Plants that are field-grown, dug with the ball of soil intact, and in lieu of burlapping, are placed in a container to retain the integrity of the soil ball. This form of nursery stock should be planted within a short period of time because field soil is a poor container media for growing plants.

In-ground Fabric Bag

Plants grown to a specified size in fabric bags within a field. These bags are constructed of the same materials as bags used for above-ground container production. Unlike plants grown in containers above ground, in-ground fabric bags are filled with field soil. Growing plants in fabric bags in-ground is becoming increasingly popular, because these plants are less prone to the problems of root deformation and post-planting drying than are standard container-grown plants, and are less perishable following harvest than balled-and-burlapped or bare-root nursery stock.

Tree Spade

Trees with trunk diameters of 3-10" can be transplanted with truck-mounted tree spades. Tree spades are available in a variety of sizes up to about 90" in diameter. The success of moving large trees with a tree spade depends on a number factors, including size and species of the tree, root ball size, time of year, location, soil type and skill of the operator. Moving trees with a tree spade is expensive and is typically used only when landscape immediacy is required or a highly value tree will otherwise be lost. Large trees suffer considerable transplant shock, and may take a decade or more to return to pre-transplant growth rates.

Selecting Nursery Stock

Trees

Both the branches and roots of nursery stock should be inspected before purchase. Selecting trees with good branch architecture will reduce the need for pruning during the first few years. Large and medium sized trees should have a dominant central leader to the top of the tree with well-spaced, subordinate branches. Trees possessing branch defects should be avoided. The three primary branch defects, codominant leaders, included bark, and branches that are greater than one-half the diameter of the trunk, are discussed in detail in Chapter 17. The presence of a dominant central leader is less important for small trees, which are often trained to have multiple stems. Small trees should have well-spaced branches that are not clustered at one location. Trees should also be free of mechanical damage to the trunk and main branches.

Roots are an often overlooked aspect of plant selection, but root structure is critical to long-term landscape performance, especially for medium and large sized trees. Roots should grow strait-out from the trunk without any circling, kinked or large descending roots. Roots growing tangentially to the trunk frequently become girdling roots that can seriously affect future tree health. Root defects are less likely on field-grown plants, but are common on plants grown in standard plastic containers, which is why it is important to address potential root issues when planting this type of nursery stock.

Shrubs

Shrubs should be full and balanced with multiple well-spaced stems. The stems should appear healthy and be free of mechanical damage or disease. As with tree roots, the roots of shrubs should be free of permanent deformations resulting from poor production practices.

PLANTING

Planting Hole Preparation and Correct Planting Depth

A planting hole should be dug two to three times as wide as the root ball, but no deeper than is required for the plant to be at the correct depth (Figure 1). Adding organic amendments to the soil before backfilling the hole is generally not recommended, but may benefit plant establishment in heavy clay or very sandy soils. If required, thoroughly incorporate an organic amendment such as compost or peat moss into the soil before backfilling so that the amendments total no more than 10% of the soil volume. Backfill the hole and settle the soil by watering the hole thoroughly. Never use your feet to compress the backfill, which can over-compact the soil.

Planting too deeply can lead to a variety of problems, the most common being the development of girdling roots. When at the correct depth, the area where roots emerge from the trunk, known as the root flare, should be visible at ground level. If soil at the bottom of the hole has been disturbed or recently backfilled, this soil should be tamped-down, and the plant can be placed slightly higher to allow for settling. It is always better to error on the side of planting too shallow than too deep. If the root flare of nursery stock is covered with soil or container media, remove enough media to expose the flare before planting. Roots that are circling or growing tangentially to the trunk should be removed.

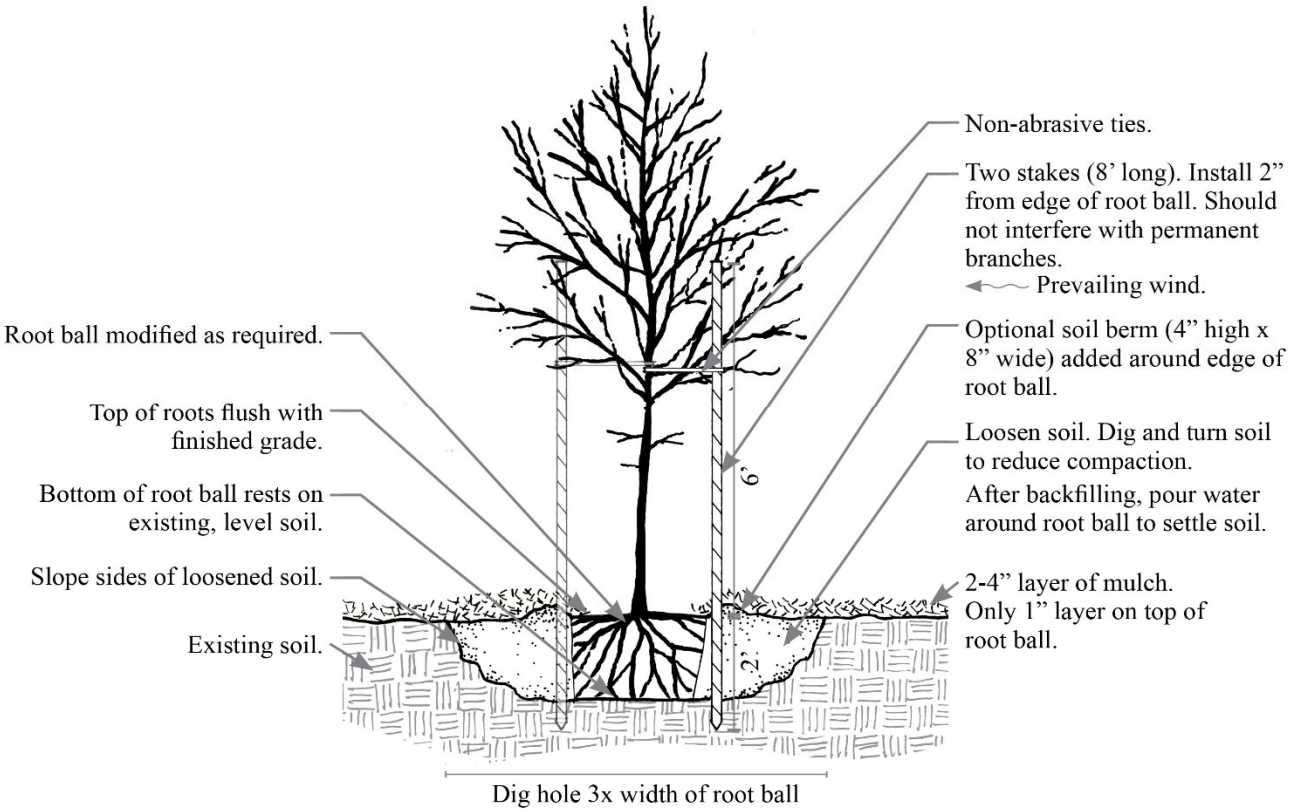


Figure 1. Correct planting hole and planting depth.

Balled-and-Burlapped

If the root ball is contained within a wire basket, the basket should be removed before planting. After the ball is at the correct depth in the planting hole, cut and pull the burlap below soil level, which prevents it from wicking moisture away from the root zone.

Bare-Root

It is important not to let the roots become dry before planting, and soaking the roots in water overnight before planting can help hydrate the roots. Prepare a wide planting hole with a mound of topsoil in the center. The mound helps spread the roots, and its height should be adjusted to set the plant to the correct depth. To prevent the plant from sinking below this level, the mound should be tamped, and the plant can be placed slightly higher to allow for settling.

Container-Grown

Traditional Plastic Containers: Plants grown in traditional plastic containers typically have deformed roots at the interface of the media and container wall. It has long been a recommended pre-planting practice to make several vertical slices through the roots around the perimeter of the root ball. Recent research has shown this method may not result in a significant change in root architecture following planting. Studies have found that the best method to correct deformed roots is to use a sharpened spade, knife or fine-tooth saw to slice-off the outer one-to-two inches of roots and media on the sides and bottom of the root ball (Figure 2).

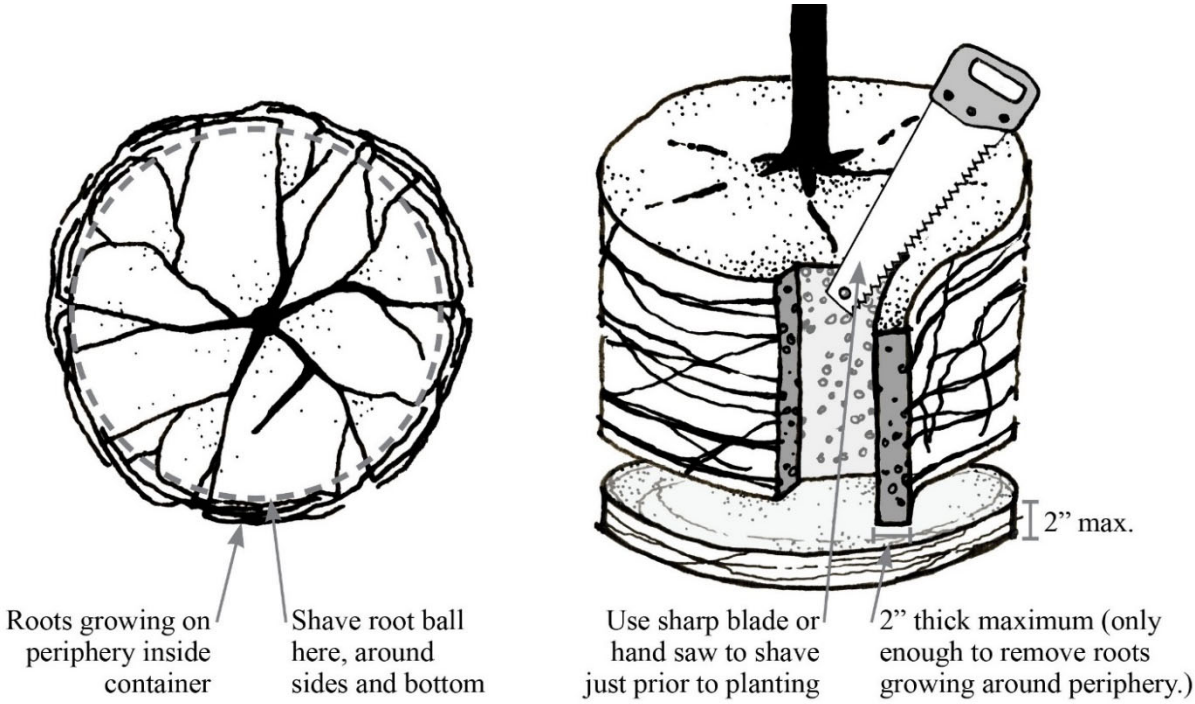


Figure 2: Shaving the bottom and outer portions of container-grown root balls effectively removes deformed roots that can lead to long-term problems.

Fabric Containers

Plants grown in fabric containers will generally have few if any deformed roots and much greater fine-root mass. Before planting, the fabric bag should be cut and removed from the root ball, and the polypropylene fabric recycled. The perimeter of the root ball should be disturbed to loosen and expose fine roots, which will facilitate their integration into the surrounding soil. Any misshapen roots should be removed at this time.

Containerized, Field-Potted, Processed-Balled

If the plant has been growing in the container for a significant period of time and deformed roots are present, it should be planted as described for container-grown plants. If few roots are visible at the outer edge of the media, loose media should be removed until roots are exposed.

Post Planting Care

Mulching

Cover the planting area with 2-4" of an organic mulch such as bark or wood chips. Keep the mulch several inches away from the trunk to prevent rodent damage and disease problems, and allow for irrigation to reach the root ball until the plant has become established. Over time the mulch will need periodic replenishment to maintain the proper depth. The mulch ring for trees should be at least as wide as the planting hole. Well-maintained mulch areas reduce weeds, preserve soil moisture, improve plant growth, and perhaps most importantly helps prevent mechanical damage to the trunk from trimming tools.

Watering

Newly transplanted plants can be as easily damaged or killed by over-watering or under-watering. The correct paradigm for watering plants is to water thoroughly and deeply, then allow the soil to dry before watering again. This practice allows for aeration of the root zone and encourages an expansive root system. Deep watering can be achieved using a soaker hose, drip irrigation, or leaving a garden hose on a low trickle for several hours. Check that the soil has dried to a depth of 3-4" before the next watering. Plants purchased in soilless media, (i.e. container-grown, containerized, or

processed-balled) should be watched more closely during the initial establishment period before the roots have grown into the surrounding soil. Under hot conditions these plants may begin to wilt before the surrounding soil becomes dry.

Prevention of Mechanical Damage

Girdling caused by mechanical damage, in particular string-trimmers, is probably the leading cause of decline and death of young trees in the landscape. String-trimmers are powerful and efficient tools, but are extremely dangerous around trees. A moment of carelessness can result in the loss of a tree that will require significant expense and years of growth to replace.

Fortunately this serious problem is readily preventable. The best prevention is to eliminate the need to get near trees with trimming tools by maintaining generous, weed-free mulch rings. Where maintaining mulch rings is not practical or outside your control, quality plastic trunk guards should be installed around the base of trees. Trunk guards should always be checked during routine landscape maintenance to ensure they are properly installed, and should be replaced if damaged or missing. Finally, it is also important to train equipment operators to stay clear of trees and to only remove weeds near the base of trees by hand.

Staking

Newly transplanted trees should only be staked in high-traffic areas where there is risk of vandalism or in areas where high winds may dislodge the root ball during establishment. If staking is required, two metal or 2 x 2" wood stakes should be driven into the ground outside of the root ball and deeper than the backfill (Fig. 1). It is important to secure the tree to the stakes using only soft, flexible material that will not damage the trunk, and to allow for some movement of the trunk, which helps develop a strong trunk and root system. In general stakes should be removed after one year. If circumstances require the stakes to remain beyond one year, periodically check that the ties have not become too tight.

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Review

A. Using the sample pages from the ANSI American Standard for Nursery Stock provided in the chapter, give the following standards for an intermediate-sized deciduous shrub in the 3-4' size interval:

Minimum number of canes _____

Minimum spread of roots or root ball diameter _____

Minimum root ball depth _____

Acceptable container classes _____

Minimum acceptable in-ground fabric bag size (diameter) _____

B. Briefly describe the following types of nursery stock:

Balled-and-Burlapped _____

Bare-Root _____

Container-Grown _____

Containerized _____

Plug or Cone _____

Processed-Balled _____

Field-Potted _____

In-ground Fabric Bag _____

Tree Spade _____

C. Describe two potential problems associated with plants grown in standard plastic containers.

_____

_____

D. When purchasing a tree, what type of branch and root architecture should you look for?

_____

_____

E. Explain the proper dimensions for a planting hole.

_____

_____

F. Describe the correct planting depth for a tree or shrub.

_____

_____

G. How do you settle the backfill in a planting hole?

_____

H. Explain the correct method of planting a tree that was grown in a standard plastic container.

_____

_____

I. Describe the proper method for watering a newly-planted tree.

_____

_____

J. List three ways of preventing the girdling of trees by trimming tools?

_____

_____

_____

K. When and how should a tree be staked after planting?

_____

_____