Certified Nursery &
Landscape Professional

C N L P

New York State
Certified
Nursery & Landscape
Professional

Training Manual

New York State Nursery & Landscape Association

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LANDSCAPE ESTABLISHMENT & MAINTENANCE

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Landscape Establishment & Maintenance

Introduction

This chapter will discuss the basics of landscape establishment and maintenance, there will be links provided for more in depth information about the concepts that are covered.

1. We will discuss how to select quality plant material and why quality and proper plant placement is important. The chapter will review the types of plant material available and the standards used by growers.
2. We will review the proper installation techniques and how to maintain the planting after installation, this will include mulch and fertilizer applications, edging materials and pruning.
3. We will also highlight lawn establish and maintenance in a section at the end of this chapter.
4. Throughout the chapter there will be concepts introduced from the NOFA Standards for Organic Land Care Manual.

Landscaping begins with the selection of quality plants that will perform their required function with minimum input over time. Horticulturists need to know what to look for when selecting quality plants, their growth characteristics, handling requirements for the various types of stock, techniques for rapid reestablishment in the landscape, and maintenance requirements. This will ensure that the plants will continue to satisfy the necessary functions for which it was chosen with a minimum of problems. Choosing the right plant for the right place is an important decision when landscaping a property, plants have the potential to outlive those that plant them. If the plant is happy in its new environment it requires less outside input such as fertilizers, pesticides or pruning and will reduce the maintenance costs and increase the value of the landscape.

Landscaping increase property values and make outdoor surroundings more pleasant. A deciduous shade tree provides cooling relief from the sun while allowing the winter sun to warm a home. Evergreens can provide wind break or screening for privacy. Plant installations can reduce runoff, filter out pollutants, and add oxygen to the air we breathe. They can also improve the overall appearance and quality of life in a city or neighborhood.

Selecting the Right Tree For Your Landscape

Selecting plant material that will thrive in a certain site condition is the key to the survival and reduced maintenance of the landscape. Consider the following when making your plant selection: soil conditions, exposure, drainage, space constraints, hardiness zone, human activity, insect and disease susceptibility. Fully assessing soil conditions, microclimate, site history, any existing vegetation, and your plans for a site will help you choose trees that will fulfill the designer's vision and require the least amount of work to maintain. Of course, all planting require maintenance, but making sound decisions up front can help you avoid the host of problems that come when a tree and its planting site are incompatible. Property damage and personal injury-for both the municipality and private-property owners-can be reduced dramatically when quality trees are selected and properly planted and maintained.

Healthy, productive and long-lasting trees start with quality nursery stock. Trees given a good start in life will require less maintenance, live longer, perform better, and cost less to care for. Some quality characteristics to look for when purchasing plant materials are: strong form and shape, the plant is free of wounds or damage, it has a quality root system that is the right size to support healthy growth. Starting with a healthy plant will increase the plants ability to prosper.

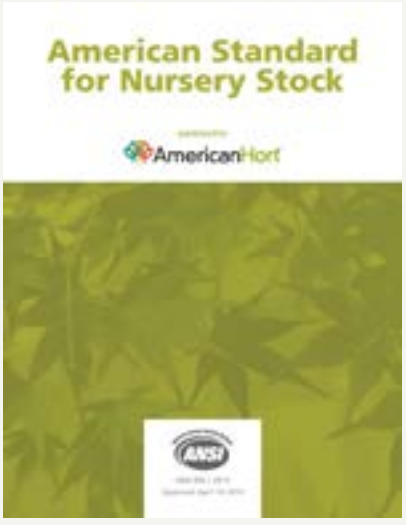
Often, plant materials purchased in quantity don't meet standards set by AmericanHort, publishers of the American Standard for Nursery Stock. https://www.americanhort.org/page/standards

This publication provides the technical information necessary to make the right choices when selecting material for community plantings and should be used by everyone who purchase plants in quantity. This chapter is intended to supplement the technical information provided in the Standard.

From Standards for Organic Land Care- NOFA

"Right plant, right place," is a key tenet of the Organic Land Care Program, refers to choosing plants for the environment, not altering the environment to fit a plant choice. Plants have evolved to grow in certain landscape niches and using this knowledge will allow the creation of resilient, low-input landscapes.

Plants that are selected, planted, and grown according to these principles thrive over long periods and better tolerate normal climatic cycles.



CLICK the image above to Download a Copy of the Standards

See Chapter 1 in the Training Manual for more detailed information on Soils and Soil Health and Soil Testing

Site Assessment

Soil Conditions, Drainage and Site History

Urban soils tend to be lower in nutrients and more compact than their rural counterpart. Critical among all soil tests is determining drainage capabilities. Standing water can kill trees faster than most other stresses. Look for gray or rust-colored soil mottling, which may indicate poor drainage. Pockets of standing water after a rain are another sure sign of problems.

You can do a simple percolation test by digging the depth of the planting hole, filling the hole with water, and timing how quickly it drains out. Anything less than one inch/ per hour warrants some remedial action such as installing drainage pipes, or using raised-bed plantings for trees and deep-rooted plants or breaking through a layer of existing hardpan soil. This will also reveal texture and soil structure, that is, clay, loam, sand, or gravel. Unsatisfactory drainage is often associated with mottled gray coloring.

Take soil samples and conduct a simple test for pH. pH determines the acidity level, which influences the availability of nutrients. For more complex projects, send soil samples to a testing lab, which will also test for fertility. Lab testing will help you determine missing nutrients or chemical toxicity.

Are there plants already growing on the site? Is the growth acceptable? The identity and condition of existing vegetation often can clue you in to site condition. If naturally occurring vegetation is growing on the site, so-called "indicator species" can tell you what may or may not do well there. For example, in much of the eastern U.S., sugar maples, red oaks, and hickories indicate well-drained soil conditions. Sycamores and tulip trees naturally grow in moist soils while tupelo, willows, and swamp white oak grow in poorly drained, wet soils. Be aware, however, that the soils around building sites will be very different from the undisturbed soil nearby.

Pay attention to the condition of existing vegetation. Are leaves showing their fall colors prematurely? Are they yellow from a lack of iron or nitrogen, a condition called "chlorotic," or are the edges of the leaves dying back? These symptoms can indicate drought, high pH, or salt damage.

Soil Health

Soil tests, along with site analysis, allow the land care professional to select and implement practices that maintain or increase soil life and vitality and thereby enable the soil to support a vigorous plant community. A healthy soil is free of crusts, compaction, pesticides and other toxins, salt buildup, and excessive erosion, and contains sufficient organic matter and nutrients, in proper balance, to support a large and active population of native organisms.

There are two approaches to matching soils and plants:

1. We can maximize the diversity of soils and plants and minimize the need to alter the soil by leaving the soil alone as much as possible and choosing appropriate plants for that soil, site, and microclimate or
2. We (or the client) can decide what plants are desired and alter the soil and site to make them suitable for the desired plants.

The first choice is the more desirable because it minimizes our effects on the environment. Organic land care follows a holistic approach to plant health, nourishing soil life instead of feeding plants directly. This is accomplished by increasing organic matter in the soil, balancing nutrients and pH, and increasing soil life through the judicious use of biologically active materials such as compost and compost tea.

Exposure

The amount of sunlight available will affect plant selection for a particular location. Some plants require full sunlight for proper growth and flowering. Some do well in, or even prefer, light shade; however, few species perform well in dense shade. Wind exposure is also a consideration. Wind can dry out soils, damage tree crowns, and uproot newly planted trees and shrubs. Special maintenance, such as staking or more frequent watering, may be necessary to establish young trees on windy sites. During particularly harsh winters, trees can topple under the weight of heavy snow or ice. Some of these tree failures can be traced back to ill-advised plant selection, poor quality nursery stock, and improper planting and maintenance practices.

Space Constraints

Many different factors can limit the planting space available to the tree: overhead or underground utilities, pavement, buildings, other trees, visibility. The list goes on and on. Make sure there is adequate room for the tree you select to grow to maturity, both above and below ground.

Hardiness

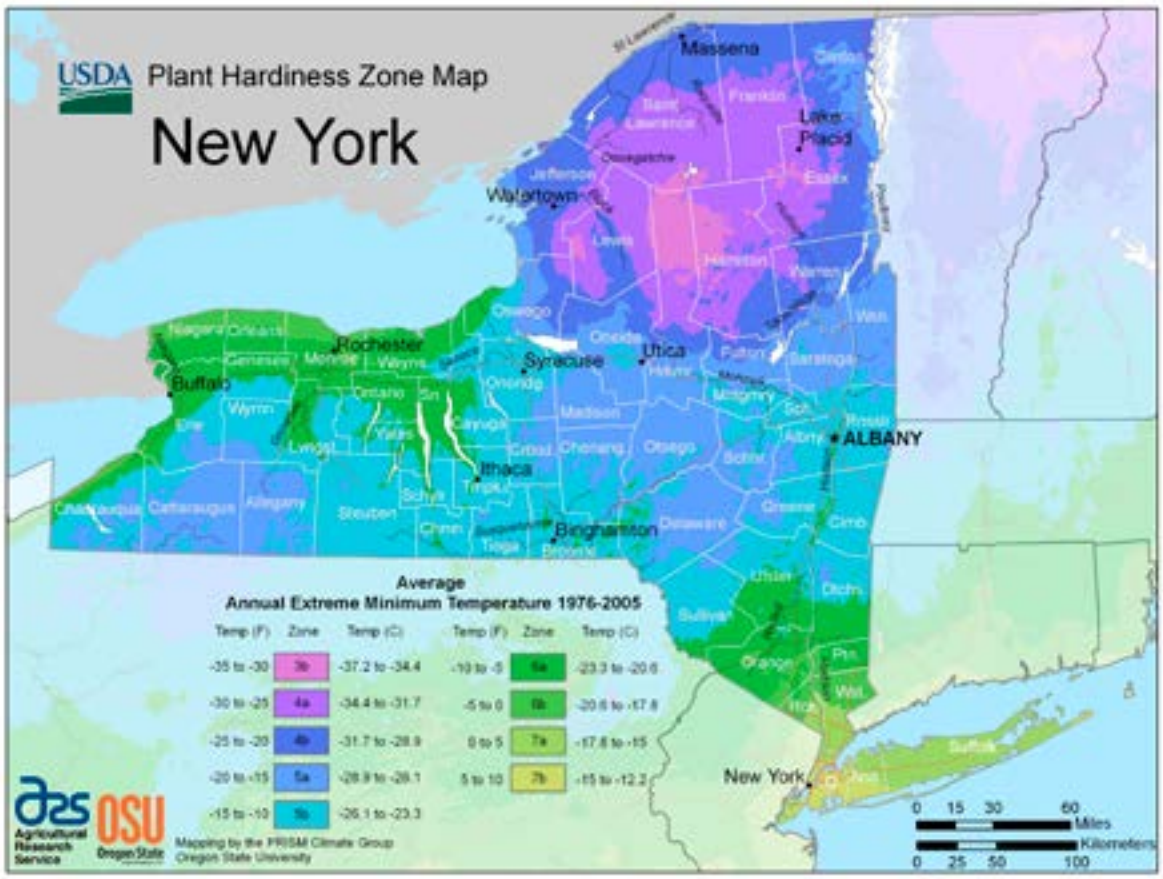
Hardiness is the plant's ability to survive in the extreme temperatures of the particular geographic region in which you are installing plant material. Plants can be cold hardy, heat tolerant, or both.

It is important to evaluate the microclimate of your planting site carefully when considering species selection and placement.

The USDA plant hardiness zone map is the standard by which gardeners and growers can determine which plants are most likely to thrive at a location. The map is based on the average annual minimum winter temperature divided into 10 degree F zones. The U.S. Department of Agriculture's hardiness-zone map is divided into Zones 1a through 13b; the warmer the zone, the higher the number. New York State ranges from zone 3b-7b so it is important to know the zone in the areas that you are installing plants. High summer temperatures should also be considered in tree selection. Keep in mind that local variations such as moisture, soil, winds, and other conditions might affect the viability of individual plants.

You should know your site's hardiness zone, but equally important, you should be able to evaluate its microclimate. Cities are warmer than surrounding rural areas, which can elevate the climate zone to another number. Sun and shade patterns and the effects of reflected heat from building facades, parked cars, asphalt, and concrete can dramatically raise temperatures around street trees. Protected areas such as courtyards can raise temperatures as well. Rising temperatures can substantially increase a tree's need for water.

Wind can either cool urban tree leaves or increase water loss from leaves, depending on the air temperature. Incessant winds on a coastal site or created by high-rise buildings within an urban canyon can increase tree injury, most noticeably in winter, necessitating the use of more wind-tolerant species. Likewise, a sheltered space may protect a tree from cold injury.



https://planthardiness.ars.usda.gov/pages/view-maps

Human Activity

Often an overlooked aspect of plant selection, the reality is that the top five causes of death result from things people do. Soil compaction, under watering, overwatering, vandalism, and the number one cause — choosing the wrong plant — account for more plant deaths than all insect- and disease-related plant deaths combined. Pest Problems Every plant has its particular pest problems, and the severity varies geographically. These pests may or may not be life threatening to the plant, but selecting plants resistant to pest problems specific to your area is the best choice.

Pest Problems

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Refer to Chapter 4 - Problems of Ornamentals for information on Common Pests

Want to Learn About 'Gravel Bed' Nurseries?

https://trees.umn.edu/learn-more/gravel-beds

Photos of Rare Earth Nursery, Cazenovia, NY

Species Selection

Personal preferences and site constraints play major roles in the selection process. Taking into consideration the factors listed above, you can help ensure the tree or shrub you plant grows and functions as desired. The plant's function is factored into the selection process: shade, wind and noise abatement, seasonal interest, or other uses. The form of the plants must be compatible with their function as well as your design intentions. For example, select a narrow, columnar tree for narrow spaces between buildings and a broad-spreading tree to shade air-conditioners and west windows for energy conservation.

Some species have been bred in a variety of forms to satisfy different functional and design needs. Always consider the plant's mature form in relation to its setting. Some species are trained to grow as single-trunk or multiple-trunk trees. Single-trunk trees are well suited to sites with pedestrian or vehicular traffic that necessitate the pruning of branches. Multiple-trunk trees, with their low-branching form, are best suited for areas away from walkways.

Using a variety of plants properly matched to the site conditions will minimize the likelihood of a pest or disease problem that would cause higher maintenance costs and lower the survivability of the plant.

Selecting Nursery Stock

Size, age and form of nursery stock:

Is a smaller tree preferable to larger, nursery-grown trees? Much depends on your ability to maintain the tree in the site, the amount of activity around and on the site, and available budget. Smaller nursery stock costs less but will need much more protection from weeds, vehicular and pedestrian traffic, vandalism, and lawn mowers. A large tree will have much less competition from weeds, at least for light, although it too will need to compete with other plants for water and nutrients. With careful maintenance, smaller trees may establish more easily than larger ones.

Types of Planting Stock

	How Sold	Hot to Plant	Advantages	Disadvantages
Bare Root (BR)				
	With roots in Moisture - holding medium such as peat or moss.	Spread roots over soil mound at bottom of planing hole and cover with soil immediately.	• Least expensive. • Roots adapt to existing soil better than B&B planting.	• Roots prone to drying if not kept moist during transplanting. • Not practical for large plants. • Availability may be more seasonal.
Balled & Burlapped (B&B)				
	With roots contained in ball of soil that is wrapped with burlap, cloth, wire, etc.	Lift tree by soil ball and center in planting area, then remove burlap around sides of soil ball. Add backfill and water to settle soil.	• Better survival rate than bare root stock, for amateur planter.	• Harder to handle than bare root stock due to weight of soil ball.
Container Stock				
	With roots in numbered containers that correspond to a tree size (such as #1, #5, #15).*	Remove container before placing soil mass in planting hole. Eliminate circling roots by laying rootball on its side, slicing with a knife.	• Slightly easier to handle than B&B. • Better survival rate than BR because of extensive root size. • Continuous availability.	• Same as for B&B. • Circling roots very common. • Root problems likely if tree is too large for container.

* Container sizes are often casually described in "gallons", though actual volumes may be less than the "gallon" designation may imply. Therefore the ASNS denotes containers by "numbered sizes" (e.g. #5 instead of 5-gallon) and specifies minimum container dimensions for common numbered sizes. Specifications should avoid the use of "gallon designations".

For most urban trees, sizes ranging from 1 1/2-inch to 3 1/2-inch caliper encompass the greatest number of trees planted. For many cities, a 2-inch to 2 1/2 inch caliper is the standard for planting street trees. Where containerized trees are used, the caliper may be somewhat smaller than that of balled and burlapped trees.

Trees of this size have more resilience in the urban landscape and can be pruned to meet municipal requirements. The ratio between height and caliper size is important for a given size of stock. Refer to the "Nursery Stock Guidelines" tables at the end of this chapter, adapted from the ***American Standard for Nursery Stock, ANSI Z60-1-2014*** for an example of height-to-caliper ratios. All the good decisions you've made during site assessment and plant selection can be undone by poor handling of the tree from the time it leaves the nursery until it is planted in the ground. The greatest problem is letting it dry out, especially with a bare-root tree. Trees in transit should always be well covered to maintain a high moisture content. Container and balled and burlapped trees should always be carried by the rootball and not the trunk, to prevent root damage.

Specifying Quality Stock

General Appearance _____

- The tree and/or shrub should have a balanced shape.
- The plant should have strong form with well-spaced, firmly attached branches
- The plant should be free of wounds or damage.
- New growth is evident and leaves are free of insect damage.
- Most tree species (but not all) should have a single strong "central leader"
  *If the tree is multi-stemmed, make certain that the trunks are well spaced at the ground level
- Check the size of the crown and rootball in relation to the caliper size of the tree to correspond with the American Standard for Nursery Stock. Their should be a quality root system to support healthy growth.

Crown _____

- For most tree species, make sure the branches come off the leader trunk at between a 45-degree and a 90-degree angle. The more the angle (the more parallel to the ground), the better.
- Wounds from pruned branches should be calloused

over or well on their way
- Branches should be distributed evenly throughout the tree. This is called good scaffolding. There should not be any "clusters" of branches.
- Branches should be about one-quarter of the height of the tree.

Trunk _____

- The trunk should be straight
- Look for insect damage such as bore holes.
- The trunk should be free of discolored, swollen, or sunken areas.
- No wound should be longer than one-quarter of the trunk's circumference.

Balled and Burlapped Trees (B&B) _____

- The trunk should not move independently of the rootball. The burlap should be tightly wrapped. The trunk should be in the center of the rootball.
- Tree roots are pruned and cut before they are wrapped. Avoid trees with cut root tips wider than an average finger.
- The more fibrous or "hairy" roots you have the better. It is stressful for any tree to be replanted, and more intact roots give the tree a better chance to survive.

Containerized Trees _____

- Potbound roots are in danger of "girdling" (encircling the inside of the pot). This occurs when the tree has outgrown its container; girdled roots strangle the tree and do not provide an adequate support system when the tree is planted.
- Avoid trees that have large roots coming out of the water holes or with roots circling on the surface of the soil.

Caliper size refers to the diameter of a tree's trunk **six inches above the ground**, if it measures 4 inches or more take the measurement at 12 inches above the ground. Height measurement shall be taken from ground level for field grown stock and from the soil line for container grown stock, which should be at or near the top of the root flare. It is an important part of selecting a tree because it will help you ensure than you are getting the proper dimensions for both the height of the tree and size of the rootball. Ideally, the larger the rootball, the better.

Caliper size refers to the diameter of a tree's trunk six inches above the ground, *if it measures 4 inches or more take the measurement at 12 inches above the ground.*

Nursery Stock Guidelines

Refer to the ***American Standard For Nursery Stock*** for complete standards. https://www.americanhort.org/page/standards

Bare Root Standards -

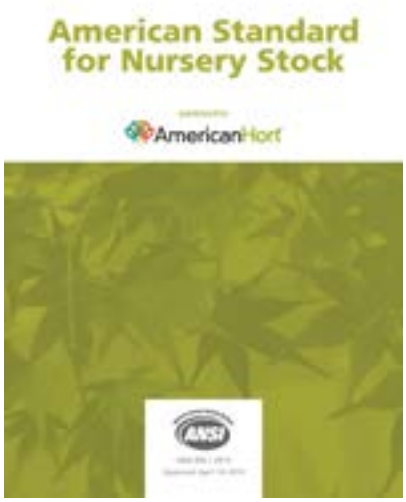
Diameter of Caliper	Root Spread	Diameter of Caliper	Root Spread
1/2 to 3/4"	12"	1-3/4 to 2"	24"
3/4 to 1"	16"	2 to 2-1/2"	28"
1 to 1-1/4"	18"	2-1/2 to 3"	32"
1-1/4 to 1-3/4"	22"	3 to 3-1/2"	38"

Container Stock Standards

Tree Type	Container Size	Height	Caliper
Broadleaf	#1	1 to 2'	1/4"
		2 to 4'	1/2"
Broadleaf	#5	4 to 6'	1/2' to 3/4"
Conifers	#5	to 6'	5/8' to 1"
Broadleaf	#15	7 to 10'	3/4" to 1-1/4"
		10 to 12'	3/4' to 1-1/4"
Conifers	#15	6 to 8'	3/4 to 1-1/4 "
Broadleaf	24" box	10 to 12'	1" to 1-1/4"
		12 to 15'	1-1/4" to 2"
Conifers	24" box	8 to 12'	7/8" to 1-1/2"

Ball & Burlap Standards

Narrow & Broadleaf Evergreens		Small Upright Trees		Conifers	
Caliper	Ball Diameter	Height	Ball Diameter	Height	Ball Diameter
1/2 to 3/4"	12"	2'	10"	1 to 1 1/2'	10"
3/4 to 1"	14"	3'	12"	2 to 3'	12"
1 to 1 1/4"	16"	4'	14"	3 to 4"	14"
1 1/4 to 1 1/2"	18"	5'	16"	4 to 5'	16"
1 1/2 to 1 3/4"	20"	5' 1"	18"	5 to 6'	20"
1 3/4 to 2"	22"	5' 1 1/2"	20"	6 to 7'	22"
2 to 2 1/2"	24"	5' 1 3/4"	22"	7 to 8'	24"
2 1/2 to 3"	28"	5' 2"	26"	8 to 9'	27"
3 to 3 1/2"	32"			9 to 10'	30"
3 1/2 to 4"	38"			10 to 12'	34"
4 to 4 1/2"	42"			12 to 14'	38"
4 1/2 to 5"	48"			14 to 16'	42"
5 to 5 1/2"	54"			16 to 18'	50"



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Transplanting

Today professionals can transplant at any time of year thanks to sophisticated digging and lifting equipment and the demand by customers. It is still advisable, however, to dig during dormant periods whether the plant has been root pruned or not. The stress inflicted by root lost does not need to be amplified further by forcing the plant to support existing foliage during the growing season.

View a detailed video from University of Kentucky: https://youtu.be/DtlP-Qj-hMc

Transplanting Procedure		
		
Tools needed:	Branches can be tied with heavy twine.	The trench is dug approx. three-fourth the depth of the ball.
		
It is then undercut and trimmed.	A piece (or pieces) of burlap is rolled or tucked under the ball and tied,	The balled & burlapped tree is lifted, rolled or slid out of the hole.

A cautionary note: Do not attempt to handle materials that are too large; soil is very heavy, and root regeneration to its original extent will take longer for large trees than for small trees. (As a rough guide, a tapered ball is considered to be about 2/3 of a cube, and the weight as 110 lb. per cu ft.)

Transplanting Shock: Large vs. Small Trees

It is common for a large tree to undergo a prolonged period of stow growth after being transplanted. This period of stagnancy can often last several years.

On the other hand, smaller trees transplanted at the same time often experience a shorter period of reduced vigor and, in fact, may surpass the larger tree in size before the larger tree has fully recovered its normal growth rate.

The reason for this appears to involve the natural balance between the portions of the tree above and below ground.

Root Loss

When a tree of any size is dug for transplanting without root pruning, as much as 90 percent of its root system is left behind. A large tree loses a much greater mass and lateral spread of roots than the small tree.

For all trees, the original balance between the roots and shoots (or at least a good portion of the original root mass) must be restored before normal top growth can resume.

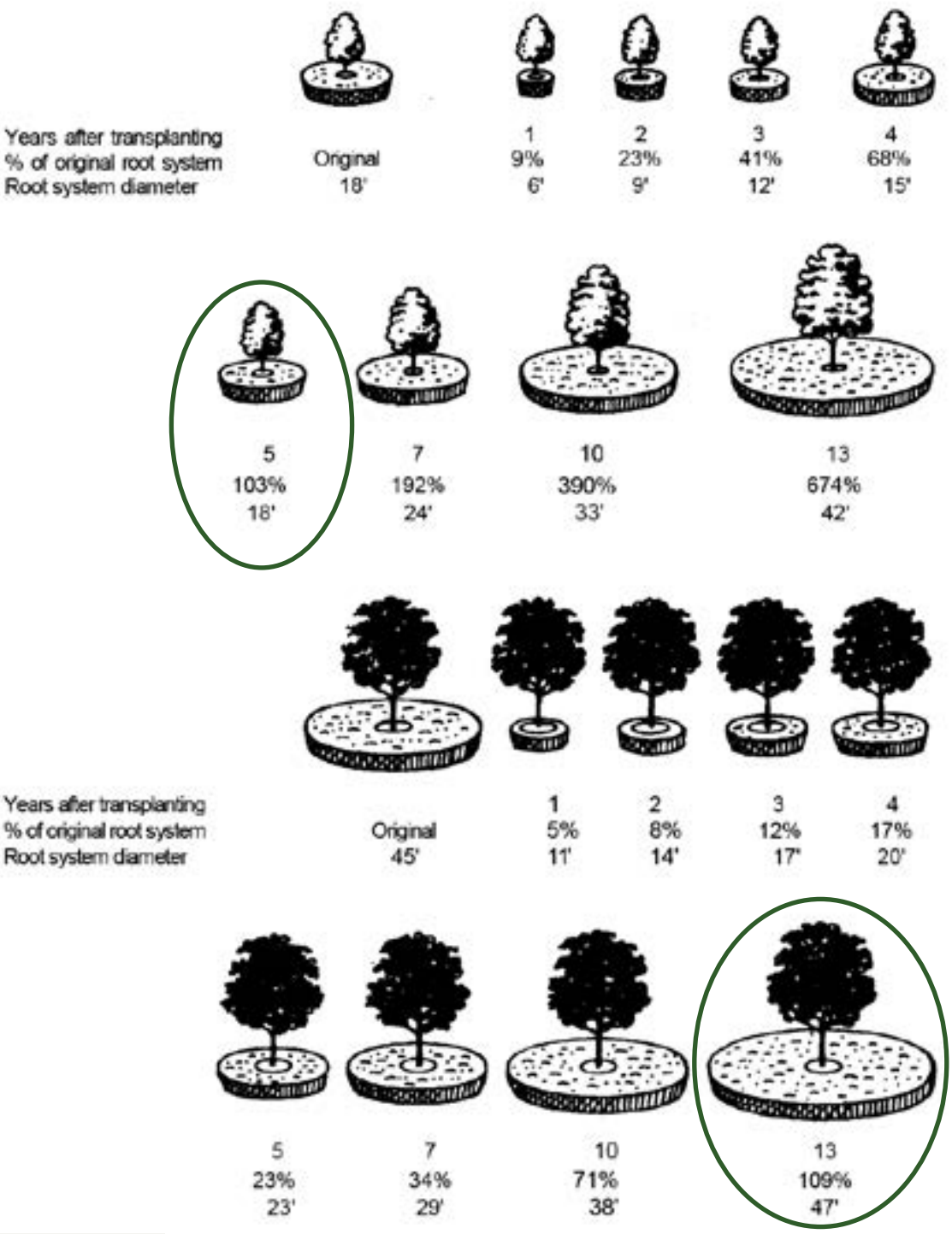
Because roots of large and small trees grow at the same rate-roughly 2 to 3 feet each year depending on plant species, soil type, and so forth- it takes the larger tree several years longer to regain the size of its original root system. As a result, large trees often undergo a longer period of slow top growth after being transplanted. Although property owners or managers may be concerned about this extended period of reduced vigor, this period of slow growth should be expected because the plant is being supported by such a limited root system. Until the natural root-shoot balance is restored, the tree will continue to experience some degree of transplanting shock (Watson 1985)

During this time, the reduced root system is unable to supply the necessary quantity of nutrients and water the upper portion of the tree needs for normal growth. That is one reason adequate watering and other maintenance is critical after replanting.

In the Northeast, a tree requires approximately one year of growth after transplanting, for each inch of caliper, to outgrow any setback resulting from transplanting. In the example given in **Figure 2,** a 4-inch caliper tree required about 5 years to regain the size of its original root system, which was 18 feet in diameter. A 10-inch caliper tree with a 45- foot diameter root system needed 13 years. The root system of the smaller tree became nearly as large as that

of the 10 inch tree after this 13 year. Thus the increase in the transplanting size of trees may provide only short-term gains.

Because the small tree has had several years of vigorous growth while the larger tree was under stress, the smaller tree actually may have overtaken the large tree in growth by the time the larger tree had restored its root-shoot balance.



Root Pruning
As noted above, severing a large portion of a plant's root system during digging induces moisture stress, causing shock to the plant. To prevent acute stress, it is extremely important to root prune before transplanting. When possible the complete procedure should be done one or two growing seasons before transplanting. To determine ball size in the root pruning operation refer to **Table 5 page 20**

The Actual Transplanting Process

The principles behind successfully transplanting any tree or shrub are relatively simple if we remember that roots:

- Keep the cells of leaves and other above-ground parts filled with water (and dissolved nutrients) absorbed from the soil.
- Serve as an anchor that prevents the aboveground plant from toppling over in the wind.
- Produce hormones that regulate top growth.

Cut and damaged roots perform none of these functions well. Thus the “intensive care” that must be provided for transplants consists of first of assisting the damaged roots to perform their primary functions and second, provide the best possible environment for quick regeneration and replacement of the missing roots. The remaining roots of the transplant must never be allowed to dry out while out of the ground, before planting, or after installation. Watering must be frequent, thorough, deep and extended for a considerable length of time after planting

Remember, the actual digging should be done one season or, better yet, one year or more after the root pruning procedure was done. Recall the diameter of the soil ball when the plant was root pruned. If the soil is dry, moisten it two to three days before digging. In addition to maximizing the water content in the plant, this will aid in soil handling during the digging process.

Table 5 - Recommended minimum ball diameters / depth of holes for sizes of trees and shrubs			
Shrubs & Small Trees		**Larger Trees**	
Height of Plant (feet)	Dia. of Ball (inches)	Tree Diameter (inches)	Dia. of Ball (inches)
1 1/2 - 2'	11"	1 1/4 - 1 1/2"	18"
2 - 3'	12"	1 1/2 - 1 3/4"	20"
3 - 4'	14"	1 3/4 - 2"	22"
4 - 5'	16"	2 - 2 1/2"	24"
5 - 6'	18"	2 1/2 - 3"	28"
6 - 7'	20"	3 - 3 1/2"	33"
7 - 8'	22"	3 1/2 - 4"	38"
8 - 9'	24"	4 - 4 1/2"	38"
9 - 10'	26"	4 1/2 - 5"	48"
10 - 12'	29"	5 - 5 1/2"	53"
12 - 14'	32"	5 1/2 - 6"	58"
14 - 16'	36"	6 - 7"	65"
Source: N.F. Childers and J.M. Beattie, 1954, Trees for Home Grounds.			

When to Plant

The most favorable season to plant woody ornamentals varies from one locality to another, depending largely on climate. In the warmer parts of New York State, planting is done successfully in spring and fall. In areas that have early freezes and long winters, it is usually safe to plant trees and shrubs in the spring. Note: the months of these seasons may vary considerably owing to regional climatic differences.

Planting time is also influenced by the degree of exposure to winds, the hardiness of the tree or shrub species to be planted, and the nature of the soil. In places where these conditions are unfavorable or where the plant is known to be difficult to establish, spring planting is usually preferable. Narrowleaf and broadleaf evergreens that are container grown or balled and burlapped are ideally planted in spring, late summer, and early fall.

When planting of evergreen trees and shrubs are planted later in the fall they need to be protected for winter by a 2 to 4 inch layer of surface mulch and screening from excessive sun and wind. The soil must also have ample moisture

before it freezes. Soil temperature is always extremely important: several weeks of 60 to 70 degree Fahrenheit temperatures at a 6 to 12 inch depth are desirable for good root development before winter arrives. Furthermore, when plants are put in during the spring, summer watering is extremely important.
Nurseries and garden centers now sell woody ornamentals throughout the summer. The plants are balled and burlapped or in containers and thus remain in good growing condition until they are planted.

Transportation and planting do not greatly disturb the root system, and with a little extra care in watering, the plants do well. Bare-root plants, however, must be planted quickly in early spring before there is any indication of growth (Note: several common species such as Tillia cordata and Acer saccharum established just as well, if not better, when planted in the fall as dormant, bare-root items) Great care must be given to these plants to avoid excessive drying or freezing of the root systems before planting.

To help reduce transplant stress anti-desiccant materials may be applied to trees and shrubs planted at a less favorable periods in summer or late fall. A second application will be necessary to ensure that the protective benefit of the material remains throughout the winter months

Late Summer and Fall Planting

Why is late summer and a part of fall a good time to plant in some regions of New York State?

Most woody plants require less moisture late in the growing season than during spring when succulent new growth is present. As the growing season progresses into late summer and fall, many of the highly hydrated cells, characteristic of most cells present in succulent spring shoot growth, have either died or become heavily lignified or both. These changes within the internal tissues of woody plants constitute some of the processes that contribute, in part, to the overall "hardening" of plants-a term frequently used by horticulturists to describe changes within plants that make them tolerant of more adverse environmental conditions. Because the demand for water is reduced in woody plants during late summer and early fall, plants planted then are less subject to acute moisture stress. The weather, also usually cooperates during late summer and early fall to provide an environment conducive to plant establishment. Shorter days, lower outdoor air

temperatures, and more rainfall result in less water loss from plants and more abundant soil moisture.

Shoot growth of most woody plants has either slowed considerably or stopped altogether by late summer or early fall. However, leaves remain photosynthetically functional well into the fall, even in the case of deciduous plants. Consequently, a considerable amount of carbohydrates (sugars being the most immediate products of photosynthesis) are produced by plants at this time. Some of what is produced is consumed in metabolic processes and structural changes (lignification) within plants. But a considerable portion of what is produced is available for root growth. Thus, if foliage remains photosynthetically functional, plants have a capacity for root growth as long as soil temperatures remain favorable (root growth of many woody plants is usually inhibited below 40° F soil temperatures) to allow sufficient time for root regeneration into the new surrounding soil.

How long does it take for landscape plants to develop new roots in fall to avoid the risks associated with winter?

Research results suggest that planting of hardy species can be made up to late October on Long Island (or until a time several weeks earlier, in September or early October, in upstate areas) without additional risk of winter injury as compared with plantings made earlier in the season. Plantings made after these dates may be more vulnerable to winter injury.

Do these suggestions apply to all landscape plants?

Plants that are marginally hardy in a particular area or that are unusually difficult to transplant may prove exceptionally difficult to establish if planted in the fall.

This is especially true in areas with extreme exposure or problem soils.

The following genera have been documented as poor establishers following fall planting:

Abies (Fir)
Acer rubrum (Red Maple)
Betula (Birch)
Carpinus (Hornbeam)
Cercidiphylum (Katsura Tree)
Cornus (Dogwood)
Crataegus (Hawthorn)
Fagus (Beech)
Ginkgo biloba (Maidenhair Tree)
Halesia (Silverbell)
Koelreuteria (Golden Rain-tree)
Labrnum (Golden Chain-tree)
Liquidambar (Sweet Gum)
Liriodendron (Tulip Tree)
Magnolia
Nyssa (Sourgum, Tupelo)
Ostrya (Hop Hornbeam)
Oxydendrum (Sourwood)
Pyrus calleryana (Callery Pear)
Some Quercus species (oak)
Sassfras albidum
Sorbus (Mountain Ash)
Taxodium (Bald Cypress)
Tilia tomentosum (Silver Linden)
Tsuga (Hemlock)
Zelkova serrata

Planting Site Preparation

Raised Beds vs In-ground

Plantings can be made in raised areas, or berms, for design and drainage-improvement purposes. In such cases, build up a layer of well-drained loam or use a mixture of equal parts of sand, soil, and compost to make a bed of loam 2 feet or more deep for shrubs and more than 3 feet deep for trees. If you are using topsoil alone or in combination, try to match it to resemble the soil on the site. Before adding the amended mixture, rototill or hand spade the existing soil. This will reduce the problem of soil interface, where water resists penetrating layers of different soil types. Put half so prepared mix over the rototilled area and till in place. Follow with the second layer and make the final pass with the tiller.

If, in the case of trees, the parent soil is 1 foot deep over rock, hardpan, or wet soil, the addition of 2 feet of mulch or well-drained loam will provide enough depth for normal function of roots and vigorous growth. For a shrub, the width of the bed should be 2 feet or more; for a tree, 6 to 15 feet or more. Set the plant in the raised bed rather than in the original ground. For a single plant, place a wall around the raised bed to prevent erosion. For groups of plants or for large areas, slope the edges of the bed down to the original level of the soil.

It is important in creating raised planting areas, or berms, either with power machinery or manually, that soil mixtures for such locations not be unduly compacted. Such compaction can result in aeration problems and can impede drainage even though the areas aboveground. Avoid moving soils wet from rainfall or overwatering to build such raised planting sites.

An in-ground planting site should be the highest-quality environment possible. This increases initial root growth during the first year or two after planting (longer for trees whose caliber is 4 inches or greater)

Heavy subsoils and excessively well drained sandy ones need to be improved before they are suitable for growing plants. Usually these soils lack sufficient organic matter and can be improved by incorporating compost. In an area being prepared for multiple plantings, prepare the entire bed

by adding a 2 to 3-inch layer of organic matter over the area and incorporate it into the top 8 to 12 inches of soil. For a shade tree, dig a single hole large enough to hold the tree and mix the soil from the hole with one-third that amount of the organic material.

When planting an individual tree or shrub in good soil, the rule for backfilling should be "what comes out goes back in". This allows the upper layer of soil to mix with the subsoil and at the same time the cultivation/digging process loosens the soil structure.

Tip:

It is helpful to place a sheet of plastic canvas or plywood on the ground adjacent to ease the mixing process and simplify cleanup.

Soil Types

Normal Well-drained Soils or Somewhat "Heavy" Soils

When digging the hole, make it as deep and at least three times as wide as the root mass of the plant you wish to plant. Sides of the planting hole should be straight (perpendicular to the ground surface) to avoid soilless air pockets around the perimeter of the hole. Ensure that sides are rough and irregular; smooth, polished sides of heavier-type soils restrict root penetration. In such cases, score the sides of the hole. Be sure the planting hole is wide and deep enough to accommodate the entire root mass.

Where soil tests indicate the need for additional nutrients, these should be thoroughly incorporated into the soil-organic-matter mix to be used in backfilling the hole. Soil tests are done at local Cooperative Extension offices.

Notice that no complete fertilizer containing nitrogen was added to the planting hole or backfill. Readily available nutrients, from complete fertilizers containing nitrogen, around the plant roots, can injure the young expanding roots and may lead to the death of the plant. Superphosphate and limestone, however, will not injure roots and, thus, can safely be added during planting.

Very Sandy Soils

Light and overdrained sandy or gravelly soils and shallow soils (less than 2 ft deep) are not satisfactory for shrubs and trees unless the soil is adequately prepared. Otherwise, plantings should be restricted to the limited kinds of plants that survive in soils of this type in New York State.

A very sandy soil is like a mass of tiny stones, with too few particles of soil between the sand grains to hold water and fertilizer materials. Plants cannot flourish with too little water

and nourishment.

If the shrub or tree is a bare root plant, dig a hole or pocket large enough to allow the roots to be spread out completely. For balled and burlapped plants, dig the hole up to twice the diameter of the soil ball. If the subsoil is very sandy and the drainage is excessive, dig a larger and wider hole, but set the plant no deeper than already noted. Soil is excessively drained if water drains away repeatedly in less than 3 minutes from a post hole 2 to 3 feet deep.

For backfill around the plant it is always best to use the native soil. Sandy soils are very low in organic matter. The organic matter content can be improved by adding about one-fourth to one-third, by volume, of well-rotted manure or compost to two-thirds to three-fourths of the soil removed from the planting hole. In an area being prepared for multiple plantings, prepare the entire bed by adding a 2 to 3-inch layer of organic matter over the area and incorporate it into the top 8 to 12 inches of soil. Firm the soil and make a cuplike area on top so that water will flow in toward the plant. Water the soil and put on a 3-inch layer of mulch from the trunk to a point several feet beyond the width of the planting hole.

Soil Amendments in Landscape Plantings

It has been said that human life depends on six inches of topsoil the top half-foot of soil where most roots grow, and most water and nutrients-are taken up by the food crops and ornamental plants we cultivate.

Many common landscaping practices, from driving heavy equipment over construction sites to the overfilling of fields, contribute to the destruction of healthy soils. In fact, the poor performance of landscape plants can be traced to poor soils more often than to any other single factor.

Once a landscape or homeowner has determined that a particular soil is compacted, poorly structured, badly drained, or infertile, he or she ordinarily wants to know what can be done to improve the soil. This is where soil amendments, or added materials, come into the picture.

Using Amendments in Landscape Plantings

Garden Bed preparation

Ideally, amending garden beds should be done before any

plants are installed. The material can be spread on the soil surface and then tilled into the top ' 6-8 inches.

To amend planted beds, one approach is to localize the amending to particular plants as described for sand or Turface. Alternately, organic matter can be spread over the surface and worked into the top couple of inches of soil. Be careful not to disturb roots of existing plants.

Green manures or cover crops are grown solely to till back into the soil. The benefits of this practice include improvement of the physical structure of the soil, an increase in organic matter content, and higher soil fertility. Clover, alfalfa, and ryegrass are commonly grown as green matures.

Tree Shrub Planting

When the soil dug from a tree or shrub planting hole has adequate structure and drainage, there is no need to amend the backfill when completing the planting. If the native soil is heavily compacted and drains poorly, however, several solutions are possible.

One approach is to create a raised bed consisting of equal parts of soil, coarse sand, and organic matter.

A second method of improving drainage is to dig a wide planting hole with a depth equal to the root ball or root mass. Backfill this wide area with the same mixture described for raised beds. If neither alternative is possible, consider selecting a different planting site with better drainage, or select a plant that will tolerate the wet conditions.

Summary

Plants that have germinated and grown in native soils do not have a need for soil amendments. Most plants grown in ornamental landscapes, however, are far from their native conditions and would benefit from amendments that increase aeration or water-holding capacity in the soil; and improve soil structure or the availability of nutrients.

Benefits and Characteristics of Principal Amendments

Depending upon the type of soil and its condition, different amendments can help to overcome a number of limitations.

In sandy or gravelly soils, for example, organic matter can increase the soil's water-holding capacity-the amount of water that can be held and released for root uptake. Water-holding capacity can also possibly be increased by

amending soil with a hydrogel, a compound of polymer crystals that swells with water that is released to roots as needed.

Soil structure refers to the arrangement of primary soil particles into other units. Organic matter promotes good structure by helping a clay soil's ability to form aggregates, the granules made up of many individual particles. The more aggregated a soil is, the better its drainage and aeration characteristics (filth). The larger pores created in a well-aggregated soil make the soil more friable, or easier to work, and allow roots to grow more freely.

While the formation of soil aggregates is a slow process aggregation can be quickly destroyed by compacting the soil. Soils with a high sand content do not aggregate well in response to additions of organic matter.

In some cases, water drainage in a heavy clay soil can be improved by amending with large-particle mineral materials, such as sand, perlite, or vermiculite to improve the texture, or relative proportions of sand, silt, and clay particles. Very large quantities must be added to positively affect soil texture.

As organic amendments decompose, they can add nitrogen, phosphorus, potassium, and other valuable nutrients to the soil. Although the quantities of these released nutrients are not great, their contribution can complement a regular fertilization program.

There are three principal families of amendments: organic, such as compost and manure; mineral, including sand, perlite, vermiculite, and Turface®; and synthetic hydrogels. The particular amendment(s) chosen depends on the type of soil, the planting situation, the plants that will be grown, and your budget.

Compost

Thoroughly decomposed compost can be of great benefit to a soil. In addition to the attributes described for organic amendments, compost has also been shown in recent research to suppress several soil borne diseases on crops such as turf grass, vegetables, and apples.

Materials appropriate for composting include all forms of yard waste (other than sticks and brush), kitchen scraps other than meat, lawn clippings not treated with herbicides, paper, and wood ashes.

It is critically important that compost be fully decomposed before it is used. Depending upon such factors as size

and type of raw materials, moisture, aeration, and micro-organisms, this process may take from one month to more than a year. Finished compost is not hot to the touch and has uniform texture and color and a mild aroma. Compost that has a foul smell like rotten eggs, ammonia, or vinegar probably has decomposed anaerobically, or without sufficient oxygen. Products of anaerobic decomposition include hydrogen sulfide (which causes the rotten odor) as well as certain acids and alcohols harmful to plants. To leach out harmful by-products, anaerobically decomposed compost should be turned and spread out in a thin pile for several months.

Many municipalities now have central composting facilities, from which finished compost is available to be trucked away. For more information on home composting, see NRAES-43, Composting to Reduce the Waste Stream.

Manure

Manures from horses, cows, sheep, and chickens can be used as organic amendments if they are first aged well. Fresh manures are objectionable to handle, may be so high in soluble nitrogen that they burn tender plants, and may have high concentrations of weed seeds. After one year of composting and turning, a manure pile should be ready for use. Even then there may be hard lumps that should be screened before the manure is incorporated into a soil.

Manures are often available from farmers for a nominal delivery fee. Manure will increase the bacterial and fungal activity of soils, making nutrients more available to plants.

Sand

Sand can improve soil texture by creating larger pores in heavy clay soils, but very large quantities of coarse sand are required to make a positive change. In fact, not until sand is 45 percent of the volume will a soil begin to have some of the properties, such as improved drainage, associated with sandy soils. In lesser quantities, the sand particles will actually fill existing pores, making drainage poorer than it was previously.

Obviously, amending with sand is an option only in very localized situations. For example, to plant particular alpine rock garden plants, one might first displace the existing soil from planting holes and replace it with a mix of 2/3 washed coarse silica sand and 1/3 native soil.

Vermiculite and perlite

Vermiculite is derived from a mica-like mineral that is

heat-treated to form flakes 20 times their original thickness. Perlite is a granite-like volcanic material, crushed and heat-treated to pop into white, hardened particles.

These materials are valuable amendments in synthetic or soilless mixes used in greenhouse bedding plant or houseplant production. In a garden, however, these materials lack sufficient mechanical strength. As the particles are crushed by the weight of the soil and surface traffic, drainage is impeded rather than enhanced.

Calcined clay (Turface®)

Calcined clay is a rigid, odorless mineral that resembles cat litter. Extensively used on golf greens to improve drainage, it can also be incorporated into soils. Some succulents and alpines that require excellent water drainage can be grown more successfully if one part Turface is added to two parts native soil.

If incorporated in large enough quantities, the calcined clay particles can keep a soil loose and aerated and produce a deep, sturdy, and healthy root structure.

Hydrophilic polymers (hydrogels)

Hydrogels are hard, crystal-like polymers which, when they come in contact with water, absorb it and expand. In theory, this absorbed water is then slowly made available to plant roots to prevent or delay water stress.

The time required to reach full expansion of a hydrogel may be as little as 30 minutes for some types or more than 6 hours for others. Individual particles will absorb between 60 and 400 times their dry weight in water, again depending on the specific type.

The first generation of hydrogels were marketed in the early 1970's. As starch-based products, their usefulness was limited by a susceptibility to rapid decomposition by enzymes and bacteria in the soil as well as ultraviolet light. This led to costly and time consuming repeat applications. Later refinements resulted in a second generation of polymers of newer materials claimed to have improved absorption rates in both pure and impure water and a more consistent water-release rate.

There are three main chemical families among the hydrogels available today: starch co-polymers, polyvinyl alcohols, and polyacrylamides.

Manufactures recommend that hydrogels be incorporated into growing media, containers and baskets, tree and shrub

planting holes, and hydroseed mixtures, and that bare-root nursery stock be dipped in a hydrogel slurry. In all cases, the hydrogel should increase water availability to the plant and either reduce the frequency of irrigating or increase the chance of plant survival.

A growing number of research reports have shown that when hydrogels absorb fertilizer salts such as iron (Fe2+) magnesium (Mg2+), or calcium (Ca2+), they break down and lose their structure. In soil, this breakdown results in decreased pore space and insufficient air to the roots. In other words, the hydrogel becomes a slimy mass in the soil that fills the pore spaces and suffocates the roots-conditions worse for the plants than if no hydrogel had been incorporated.

One exception to this general problem could be in the use of hydrogel slurries for bare-root dips. In this use, the hydrogel increases the short-term availability of water to the roots. Early studies showed that they may increase plant survival rates by 20 percent.

A second specialty use for hydrogels is in hydro-seeding slurries, In such mixtures, grass seed, straw (or other bulking agent), fertilizer, and water are kept in suspension for spraying onto sites to be seeded. The hydrogel may provide improved seed-to-water contact until germination occurs.

For other uses, where the hydrogel is incorporated directly into the soil or a growing medium, caution is advised. If you plan to try one of the hydrogels currently on the market, you will probably increase their usefulness by using only slow-release fertilizers and irrigation water low in soluble salts, but this frequently is not possible. The first two generations of hydrogel products have their shortcomings; now we just have to wait for further improvements.

Immediately after Planting

Watering

Water, either too much or too little, can be a major factor in the survival of newly transplanted trees and shrubs. At planting, the soil around the trees and shrubs should be settled into place with an initial heavy application of water. This will eliminate any air pockets through which newly developing roots could not grow. Water will also move with greater uniformity from the soil surface, through the root ball, and into the surrounding backfill.

How much water should be applied? This depends on rainfall, moisture retention of the soil, and drainage. As a general rule, 1 inch every 5-7 days should be adequate during the first growing season. However, during drought periods following spring planting and on sandy, well-drained soils, two 1-inch applications per week may be necessary; this is also true for container produced plants that have masses of roots initially contained in a limited area. If rainfall is insufficient during the first fall, continue supplemental watering until the ground freezes. As always, apply water slowly so that it percolates deeply and distributes uniformly.

Never sprinkle with light waterings! Even a brief rain shower of 1/4 -1/2 inch should be supplemented by additional watering. If using a lawn sprinkler to water a bed area, place a can or rain gauge near the plants to be watered and irrigate until the can contains 1 inch of water.

NOFA

Conservation of both water supply and water quality should be factored into all site design, construction, and management practices.

“Right plant, right place”—selecting native and noninvasive exotic landscape plants and lawn grasses that will thrive under local temperature and climate patterns

Planting at times of year when rainfall is plentiful and the need for irrigation is low

Rainfall-only irrigation for lawns and landscapes after turf and plant establishment. Native plants and noninvasive exotic plants and lawn grasses, once they have been established, should not need supplemental irrigation.

Mulching

Primary reasons for applying a mulch at planting are moisture retention, suppression of weeds, moderation of soil temperature extremes, and to lessen the damage from lawn mower and string trimmers. Mulching can also increase fine root development in the top 6 inches of soil, partly because grass is eliminated. Aboveground growth is also increased by mulching. Some lawn grasses, in fact, reduce growth of trees and shrubs. Apply a mulch immediately after planting within the area that is enclosed by the water basin. If semi-hardy plants are planted later in the fall, this application should be delayed until a hard frost has occurred. Some good materials include wood chips, shredded bark or nuggets, cocoa hulls, pine needles, and non-packing leaves. These are generally put on about 2-3 inches deep. Depths greater than 3inches will reduce gas exchange i.e., the root's ability to respire or breathe (Greenly 1994). Always apply mulch evenly, **avoid building a volcano around the tree's base**, and never placed the material up against the trunk or crown. **Figure 3.** Mulches derived from crushed stone, marble chips, and gravel can be used. However, these do not break down to provide beneficial organic matter and may also become maintenance problems by being dispersed. Black plastic and synthetic cloth or fiber-type geotextile mulches are alternatives but have numerous horticultural disadvantages, including aesthetics. If a light covering of organic mulch is used to camouflage the plastic, as it decomposes it can serve as a germination medium for weed seeds that are blown or physically carried into that area. This potential development of weeds negates the weed suppression normally anticipated with mulches. The roots of these weeds can penetrate the fibrous material of the geotextiles and extend into the soil beneath. In addition, if being installed on a large area, plastic will restrict water movement into the soil and less punctured.

Figure 3 - Correct Mulching method.

Staking

Researchers in California have determined that staked trees in a nursery had poor caliper development and less taper than did unstaked trees. Their data suggests that staking should not be done too rigidly. We believe, on the basis of these findings, that staking is still advisable in problem situations where the risk of blowing over is great.

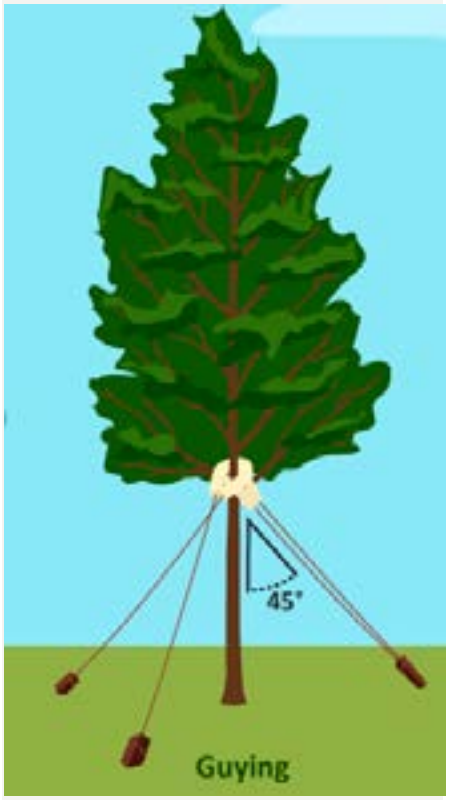


Figure 4 - Correct Guying Method.

A tree should be stabilized with guys to hold it in an upright position and prevent loosening of the soil around the roots as the plant moves in the wind. Generally, only trees over ½ inch in diameter should be staked. On a small trees a single stake is often used, placed on the side of the prevailing wind. Two stakes are usually preferred for trees 3 inches or less in caliper. Larger trees generally require a triangular system of three guy wires attached to stakes driven into the ground. **(Figure 4)** Whichever method is employed, be sure the stakes are driven into the ground outside the perimeter of the planting hole and that the wire is encased in a piece of old garden hose where it comes in contact with the bark of the tree. Once the staking has been accomplished, do not ignore it! Examine it occasionally to be sure the wires are not excessively loose and or taut and that no injury is being caused to the trunk. Generally, after the end of the first entire growing season, the supports can be completely removed. This is extremely important. Quite often trees are seen in the landscape completely girdled by wires that have been left in place.

Wrapping and Other Protection

Although wrapping is no longer recommended, a shelter may be desirable during the first winter or summer following planting to protect very young or tender trees and shrubs against weather extremes. Burlap, snow fencing, or other physical barriers may be installed as wind breaks.

In areas frequented by rodents, rabbits, and deer the lower portions of tree trunk should be protected with a cage of hardware cloth, chicken wire, or metal fencing. The height will depend on which animal is attacking.

Plastic tree guards (or flexible plastic drain pipe that has been slit down the middle) can offer protect against mechanical injury for mowers and string trimmers. (These protective devices should not be considered a substitute for mulching, however)

Pruning

If your tree or shrub has been dug carefully and handled properly, the only pruning that will be needed is to remove broken branches as well as any that cross or rub other branches.

For proper form and branch development in the tree in later years, selectively thin out some branches while the tree

is still young, either at planting or a year or two thereafter. (Some nurseries do this during the production process). Prune to develop an alternate branching pattern so that the remaining branches radiate out in different directions from the trunk. If the trees are straight and single-stemmed, as most are, be sure not to damage or remove the central leader.

If the leader of an upright evergreen is injured during transplanting, prune it off, and tie a new branch in its place. One of the side branches nearest the top of the tree should be selected and bent into an upright position. A small stake can then be used as a splint in tying the new leader in position.

Fertilizing

Newly planted trees and shrubs do not need to be fertilized the first year that they are planted.

In NYS the fertilizer rules and regulations are always changing. It is best to always best to know what the current regulations are by checking the NYS DEC website:

https://www.dec.ny.gov/index.html

https://www.dec.ny.gov/chemical/67239.html

The Basics

Mulching

As stated earlier in the section on mulching immediately after planting, mulches have many benefits. As organic mulches decompose, they should be reapplied. Certain organic mulches decompose quite slowly; there is no need to reapply them until breakdown has occurred. In garden areas prone to early frosts in fall or subject to rodent problems, keep the mulch at least 2 inches away from the stems of shrubs. Move the mulch back the following spring.

Always use a rain gauge to measure the amount of water put on.

Watering

Once a plant has been put into the ground, how long must it be watered? The question that must be answered is, How long does it take a plant to become established in a landscape environment? This is a very difficult question to answer. In a site having a well-drained rich soil and adequate fertility, a plant will establish readily and have a significant buffer to the drying out of the root zone. However, on a more droughty soil, the plant will need supplemental watering for 3 or even 4 years following planting.

After the initial planting year, a tree or shrub will invariably need water during any drought period occurring the following season. However, unless the growing seasons henceforth are very dry, supplemental watering should not be required.

It is always important that a plant enters the fall and winter season with ample moisture in its system. Research has shown that the period from mid-August through September is most important in preparing the plant for tolerance to winter stresses. Once winter arrives and the ground freezes, water cannot be replaced in the plant when it is lost because of transpiration by sun and wind.

Although supplemental watering for established plants is done quite infrequently, it must percolate sufficiently to force roots to grow deeper into the soil in search of water. One inch of water will normally penetrate to a 10-12 inch depth in a sandy loam and 6-8 inches in a heavy clay soil.

Fertilizer Application

Needs and Objectives

Fertilizers improve the appearance and condition of ornamental trees and shrubs and enable the plant to resist specific diseases and insects. Fertilizer response varies with the plant as well as the environment. Soil fertility; aeration, drainage, exposure to sun and wind, temperature of the site, and proximity to buildings, walks, and streets are but a few of the many factors that influence plant growth.

Best growth depends upon the landscape use of the plant. The largest plant is not necessarily the best. Fertilizer comes second to water in producing color and size, two attributes of good growth.

The extent to which fertilizers are applied for established plants depends upon the fertility of the soil and growth desired. If plants are growing well and look good, you may choose not to add more fertilizer. For additional growth, more fertilizer would be added. This is also true where malnutrition is evident, as indicated by poor foliage color and short and weak growth not caused by lack of moisture of fungus or insect attack.

General Plant Nutrient Needs

Essential elements for plant nutrition include nitrogen, phosphorus, potassium, calcium, zinc, copper; molybdenum, magnesium, iron, sulfur, manganese, and boron. They come from the soil and from applied nutrients. Carbon, hydrogen, and oxygen are obtained from the air or through the soil.

Certain elements such as boron, zinc, manganese, iron, copper, and molybdenum are spoken of as trace or minor elements, because plants require very small amounts of them. However, they are just as essential for plant growth as elements required in larger amounts like nitrogen, phosphorus, and potassium.

Types of Fertilizers for Woody Plants

For convenience and adequate fertilization of most woody ornamental plants, home gardener's use a complete fertilizer, that is, a fertilizer containing all three of the major fertilizer materials. The law requires that every package of fertilizer be labeled to show the guaranteed minimum percentages (or grade) of the three major fertilizer nutrients.

Failure to follow the manufacturer's directions of foliar fertilizers and chelates may result in plant injury.

Spray on cloudy days or in the evening.

For example, a 10-6-4 fertilizer contains at least 10 percent nitrogen, 6 percent phosphoric acid, and 4 percent potash. Many grades of complete fertilizers are available.

Inorganic types. Many complete fertilizers are composed of simple chemicals quickly absorbed by plants. These inorganic fertilizers, some of which are readily soluble in water, are the least expensive and can be bought at any farm or garden-supply store, but they require some care for safe application during the growing season. In addition, inorganic fertilizers are also sold in liquid form.

Organic types. Natural organic fertilizers and synthetics (urea-forms) release their nutrients somewhat more slowly. Many of these organic or synthetic forms are incorporated in other all-purpose fertilizers, which are widely available. These will appear on the label as water-insoluble nitrogen (WIN), for example, urea-form, IBDU, and sulfur-coated urea. They are more expensive, but the danger of burning plants is reduced provided recommendations on the package are followed explicitly. Barnyard manure is relatively low in nutrients and usually contains many weed seeds. Weed-free fertilizers are preferable even when manure is availably without cost. Commercially dried manures are very expensive for the benefits received.

Readily soluble fertilizers. Readily soluble fertilizers are high analysis (for example 20-20-20), dry, concentrated fertilizers. Most of their components are derived from inorganic sources. Usually the recommendations are to dissolve a specified number of ounces or teaspoonfuls in a particular volume of water. When recommended rates are used, they can be applied safely to growing plants. In borders, the ease of application is a major advantage, for more uniform distribution of the fertilizer can be made than by using dry materials.

One of the concerns in using readily soluble fertilizers is that nitrogen can be readily leached. To alleviate this concern, formulations are available that combine soluble forms with controlled-release forms of nitrogen.

Complete liquid fertilizers. Complete liquid fertilizers are similar to readily soluble fertilizers. The only difference is that they are liquid concentrates. Usually a small amount of the concentrate is diluted in a larger volume of water to make a working solution. The manufacturer's recommendation should be followed to avoid plant injury. Complete liquid fertilizers can be used in the same manner as readily soluble fertilizers. The advantages of ease of

application and uniform distribution are the same as for readily soluble materials.

Foliar fertilizers. Foliar applications of readily soluble fertilizers offer homeowners advantages as well as disadvantages. Advantages include convenience and ease of application, correction of minor element deficiencies, and "green-up" of yellow, nutrient-deficient foliage. Foliar-applied nutrients may improve the appearance and growth of plants that do not receive and adequate nutrient supply through the roots. However, foliar applications of fertilizers should generally: be looked on as a supplement, not a substitute for soil applications of fertilizers Foliar nutrition may effect lively supplement root nutrition throughout the growing season, but it is generally not economical for homeowners to attempt to provide all the nutrient requirements of a plant through the foliage.

The problems occasionally associated with foliar applications of fertilizer are mainly a result of not following the directions of the fertilizer manufacturer. Only those materials that give specific recommendations for use as a foliar spray should be used, and directions should be closely followed.

Chelates. The application of chelated iron to the soil produces a longer lasting effect than spraying the foliage. Repeated applications are often necessary to maintain attractive green foliage. The addition of chelated iron is supplemental to regular fertilizer practices for certain plants. Chelated iron is now available in garden stores. Carefully follow the manufacturer's recommended application rates. Spray on cloudy days or in the evening.

Methods and Timings

There are several methods of applying fertilizers to trees and shrubs. The method selected depends upon soil characteristics, site factors, cost, and type of nutrients to be applied. Follow fertilizer label directions for rate and application information.

- **Surface application/broadcasting:** Granular forms of fertilizer may be spread by hand or mechanical spreader over the surface of soil around trees and shrubs. This method is quick, easy and inexpensive, and recent studies have shown this method to be as effective in supplying nutrients to plant roots as other techniques. It is particularly appropriate for applying fertilizers to

Importance of Monitoring Insect and Disease Problems

No tree or shrub, whether newly planted or long established, is immune to problems caused by insect and disease attack One should always keep in mind that plants in good vigorous condition, rather than in a weakened state, are less prone to insect and disease attack.

Being aware and observant of present and potential problems that affect plants is extremely valuable to the home gardener and professional horticulturist alike.

mulched areas and shrub borders. A tree growing in a lawn area will utilize nutrients from surface applications of fertilizer made to the lawn and may not need additional fertilizer.

- **Fertilizer spikes/stakes:** With this method, solid rods of a pre-measured amount of fertilizer are placed in holes in the soil around woody plants. Wide spacing of holes and slow lateral distribution of nutrients limit the effectiveness of this technique. It is not recommended.
- **Foliar fertilization:** This technique entails spraying liquid fertilizers onto the foliage of plants. It is used primarily as a "quick fix" for minor nutrient element deficiencies. Foliar feeding is not effective in supplying essential nutrients in quantities necessary for satisfactory growth. The most effective time to spray foliage with micronutrient solutions is just before or during the growth period.
- **Liquid soil injection:** This is the method most often used by professional arborists because it is quick, easy, and also leads to rapid uptake of nutrients. It utilizes high pressure injection of liquid fertilizer into the soil. Injection points should be 2-3 feet apart depending upon pressure and about 8-12 inches deep. Slow-release forms of liquid injection fertilizers are also available.
- **Drill hole:** This technique requires drilling holes into the soil and distributing granular fertilizer evenly among the holes. Holes are drilled to depths of 8-12 inches and are spaced 2-3 feet apart in concentric circles around the tree, beginning at a point about 1/3 the distance from the trunk to the drip line and extending 1-3 feet beyond the drip line. While rarely used today on a commercial scale, this method is effective in opening heavy compacted soils, allowing fertilizer, water and air to reach the root zone. The holes may be left open or filled with compost, peat or other organic material. The drill hole method should be used where high fertilizer rates or fertilizers with a high salt index create a potential for injury to fine turf.
- **Tree trunk injections:** Injections of nutrients directly into a tree is used almost exclusively to correct minor element deficiencies, e.g. iron, manganese and zinc. This technique may also be used in urban settings where root or surface applications of fertilizers are not practical.

When to Fertilize

Spring applications of fertilizer may be made just as the leaves are beginning to open. Fertilizers often burn roots if applied in extreme heat. Do not fertilize trees or shrubs from mid-spring through mid-October as an application made at this time may stimulate new growth that may not harden off before winter. Be aware that different counties in NYS have laws that prohibit lawn fertilizer applications at certain times of year between December 1 and April 1. This is to protect our water quality; it is wise to avoid fertilizing trees and shrubs at this time as well. An additional application may be made in the fall when the tree is dormant, generally starting about September 15-October 15 in central New York, about October 1-November 1 downstate, and in milder areas near the Great Lakes and Long Island, continuing until December while the soil is still warm (above 40F)

NOFA

Fertilizers and soil amendments are tools that enable us to modify existing soil conditions. The “feed the soil” principle is used to benefit plant health, not artificially stimulate plant growth. Unnecessary applications of any fertilizer or soil amendment—including those listed as Preferred or Allowed in these Standards—can cause nutrients to build up to excessive levels in the soil. At such levels, nutrients may enter local water resources. Nitrogen and phosphorus are the nutrients most involved in eutrophication of water bodies (nitrogen in oceans, phosphorus in lakes and ponds), and are thus of major concern as pollutants. Nitrogen can also be a hazard to human health when it pollutes drinking water supplies.

Good stewardship of the environment requires that soil tests be performed to obtain an accurate picture of the soil chemistry on a particular property. If it is determined that soil requires amendment, it is preferred to use renewable materials that are locally and sustainably produced. Compost, compost teas, cover crops and green manures are examples. Compost improves soil structure, reduces runoff and compaction, enhances biodiversity, increases water and nutrient retention, increases root growth, helps prevent and suppress plant diseases, detoxifies certain pesticides, and inactivates or kills potential human pathogens. Improved establishment of turf, ornamentals, and shade trees; improved foliage color, improved plant performance in marginal or poor soils; and reduced often eliminated need for fertilizers, pesticides and irrigation.

Fertilizer Indications

New Trees and Shrubs Newly planted trees and shrubs should NOT be fertilized the first year. If necessary, begin fertilizing the tree the second year after establishment.

Young Trees and Shrubs: If indicated, broadcast (scatter evenly) on surface over root zone. Use slow-release fertilizer; follow label directions.

Established Trees: Fertilizer should not be needed.

Acid-loving Plants (rhododendron, azalea, mountain laurel, holly, andromeda) If soil pH is above 6.0: Apply up to one pound ammonium sulfate per 100 square feet as shoots begin to grow, as indicated by a soil test. If soil pH is below 6.0: Since the soil is already acidic, a regular, non-acidic fertilizer may be used.

Fertilizers and the Environment

Fertilizers are a necessary input for landscape plantings; yet when fertilizers are applied in excess or improperly, various nutrients escape from the horticultural system and damage the environment. Nutrients escape from the horticultural systems in various ways depending upon the chemical and biological nature of the element.

Nitrogen, regardless of the chemical form added, converts to nitrate and is lost in the soil water or by erosion in the soil organic matter. Thus, nitrogen may be a problem in groundwater as well as in the surface waters.

Phosphorus is usually bound tightly to the soil particles with only very small amounts in the soil water. It may also occur in organic materials. Some of these organic materials are water soluble. Phosphorus is usually lost by surface runoff and erosion.

A number of techniques help prevent nutrient loss to the environment. The most effective method is to add the amount of nutrients needed, but not to exceed crop needs. Don’t overfertilize. The second technique is to apply the fertilizers in a manner to achieve efficient plant uptake. Preventing soil erosion is also a necessary part of protecting the environment.

Edging materials and their use in the Landscape

One way gardens may be distinguished from natural areas is by defined edges or perimeters: Landscape edgings are useful materials for defining beds and preventing the disappearance of edge lines. If the edges of beds are not in some way delineated, in time they will be destroyed by encroaching weeds or grasses, or by mulches that have slipped out of place. Edging materials can be as sophisticated as bricks laid at a 45° angle or as simple as wooden boards. The primary function of all landscape edgings is to form a clean, neat line between two areas that differ in design, ground treatment, or plant content.

Edgings also help to contain mulches such as wood or bark chips, and keep them from migrating into lawns or paved areas. Edgings can also hold paving units or bricks in place and prevent them from shifting. In some cases, edgings can serve double duty as retaining walls, allowing for grade changes between garden areas. A single type of edging, used in a variety of garden settings, can tie together the entire landscape to create a sense of unity.

Edgings are also quite useful in reducing the labor involved in maintaining beds. When edgings are used there should be less hand trimming of encroaching weeds or grasses, less time spent replacing dislodged mulches, and no need to annually edge beds by hand with a spade.

Features To Look for in a Landscape Edging

Your choice of landscape edging will be determined by the type of garden, materials cost, and personal preference. All edgings should meet certain criteria:

1) They should be readily available in whatever quantities are needed and at a relatively low cost;

2) They should also be easy to install;

3) Edgings should be durable; the materials should not crack, rot, rust, or heave out of the ground. Unfortunately, heaving is fairly common and is discussed in greater detail later.

4) Generally, an edging should be high enough to contain a mulch layer, and still allow the wheels of power equipment to ride over it. Keep in mind that too-high edgings are more likely to cause pedestrians to trip and fall.

Selecting the Right Edging Material

For most residential and commercial settings, select an edging that provides a clean, neat line with a low-key profile in the landscape. Steel, aluminum, and plastic edgings usually meet these needs, as described below.

To change grade level while edging a bed, consider using landscape timbers, loose-set fieldstone, or retaining-wall block. To prevent heaving or collapse of retaining walls, always follow recommendations for establishing a sand or gravel base, alternating or overlapping layers, and stepping back or pinning wall units to hold them in place. These same materials can be used to contain and edge raised beds.

Colonial-period effect can be achieved by setting used bricks at a 45° angle along the edge of a bed. For a woodland walk, you may choose an edging of cobblestones, sunk 1/3 into the soil. To prevent loose mulch from being scattered onto a paved drive or sidewalk, set pressure-treated 1x4 inch boards on edge, with 1 1/2 inches above grade level.

Plastic edging

Flexible plastic edging is by far the least expensive of the commonly available commercial edgings. Its primary benefits are low cost, ease and safety of installation, resistance to wear, and ability to conform to contours in the landscape. These plastic materials will not corrode or rust, but they can become brittle over time.

Typically, plastic edgings have a round bead along the upper edge that sits just above the soil line when installed.

Plastic edgings are often faulted for their tendency to heave out of position, especially where sections are joined. This problem occurs most frequently with alternate freezing and thawing of the soil (frost heaving); it has also been observed during the growing including horizontal flanges or grooves, vertical slits, V-shaped base lips, and steel or aluminum anchor stakes. The performance of these modified products is mixed, but as a rule, the more heavily grooved and/or staked the edging the more likely it will stay anchored.

Steel edging

Often costing 3-4 times more than plastic edgings, steel edgings are heavy-duty elements that provide a permanent, stable appearance in the Steel edging landscape. They are more appropriate in commercial, corporate, or park settings, and less suited to residential sites.

Steel edgings are less likely than plastic materials to heave or shift. They do not crack, rot, or crush, but they can rust. To prevent rusting, steel edgings can be coated with protective painting before installation.

Steel edgings are quite popular for installation between walkways and turf, or along the edges of asphalt driveways or planting areas. Straight sections, as well as pre-formed squares and circles, are available. To form large curves from straight sections of edging, it is necessary to have a vise or curving unit on site. Minor curves can be made by driving metal rods into a trench that follows the desired shape, and then forcing the edging along the rods. Once the trench is refilled, the rods can be removed. Steel edgings are kept in place with tapered stakes that are driven through tabs in the edging, and then into the soil.

Aluminum edging

Aluminum edging offers combined advantages: It is flexible and relatively easy to install like plastic, yet long-lasting and wear-resistant like steel, and aluminum edging will not rust. With one of the permanently bonded finishes, aluminum is slightly less expensive than steel per linear foot.

Wood edgings

Landscape timbers, finished lumber, and rough-sawn logs all may be used as edging materials. or use a rot-resistant species, such as cedar or black locust, wood will eventually decay to some degree.

As a general safety rule, wood that has been treated with a preservative should not be used around food crops, including vegetable gardens and fruit plantings. Always wear protective gloves when handling treated wood.

Splintering is another problem with wooden edgings. Make sure that all exposed edges and ends are kept sanded smooth; inspect the full length of the edging at least once per season. Unlike plastic, aluminum, or even steel edgings, wood does not bend around curves, and thus is best used for enclosing geometrically shaped beds, or where a long, straight edging is needed. An exception is a type of slatted wood edging having a flexible vinyl backing or wire attachment. This material is generally used to enclose small garden beds, and is rarely used in public or commercial settings.

Wood boards, timbers, or logs can be raised partially or entirely above grade level, or they can be set flush with the ground. A flush set is appropriate when containing bricks or

paving blocks in a patio or deck. Any of these materials can also be stacked to create enough height for a raised bed on the inside of the edging.

To keep wood edgings permanently in place, they must be nailed or bolted to anchors underground. Timbers, and logs can be bolted to footers that are set perpendicular to the edging itself. Vertically set pressure-treated boards can be nailed to horizontal footers below ground. Use only galvanized hardware to prevent rusting.

Bricks, Blocks and Stone

Brick, block, and stone materials can be used effectively as edgings when a Colonial or Victorian look is desired. Cobblestones or fieldstones can also enhance a woodland path or naturalistic landscape. An especially attractive way to edge a garden bed is with bricks or aggregate blocks set at a 45° angle to the ground. Normally, about two-thirds of each unit is exposed above the soil. Preformed concrete edgings have gained in popularity in recent years. These sloped units blend well with the landscape, can be ridden over with mower wheels, and retain mulch. Lay any of these edgings on a level 2-inch base of coarse builder's sand to reduce shifting. Use a rubber mallet to set individual bricks or blocks firmly against each other. An obvious advantage of mineral edging units is that they can be set to conform with virtually any shape or con-tour. Although they do not rust, rot, or splinter, individual units can break in time, and should be checked periodically.

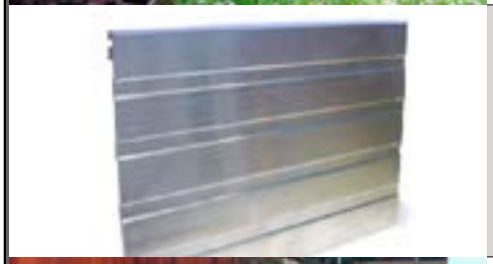
Managing Edgings in the Landscape

When edgings are used to separate a lawn from another landscape feature there is inevitably a question about how to trim the grass where it meets the edging. If the edging is low enough, a mower can follow the edge and cut the turf at or above the height of the edging. Where the edging is too high to mow over, then it is usually necessary to use a string trimmer.

Edgings low enough to accommodate mowers, however, may not be able to effectively contain mulch. One way to prevent this problem is to form a downward slope in the garden bed, with the lowest point against the edging. Ill this manner, you can maintain a uniform thickness of mulch that will be trapped against the edging.

Edgings should unify a landscape; not pull it apart or be distracting. Therefore, it is best to use a minimum of different edging materials, at least in a single landscape

having parts that are viewed together. If a particular edging does not seem successful, either functionally or from a design sense, replace it with something more appropriate. Edgings can be the finishing touch to a well-designed and maintained landscape, but they will not correct a poor design-just as the best dessert cannot excuse a poorly prepared dinner.

Types of Landscape Edging	
	**Plastic**
	**Steel**
	**Aluminum**
	**Wood**
	**Brick, Stone Block**

Pruning

This portion has excerpts from 'An Illustrated Guide to Pruning Ornamental Trees and Shrubs' for more information you can check out the compete guide

https://ecommons.cornell.edu/handle/1813/3573

What is Pruning and Why Prune

Pruning involves the selective removal of specific parts of a plant for the benefit of the whole plant. Most commonly shoots and branches are pruned, but pruning may also be practiced on roots, flower buds, seed heads, or fruits.

One unifying principle of pruning is that the pruning of "ornamentals should modify plant growth in accordance with the natural growth character of the plant. Pruning should be viewed as a regular part of a maintenance schedule, rather than as a remedial correction of long neglected problems."

For each pruning practice, there are techniques that minimize wounding of the plant and help speed the plant's closure of the wound. A thorough knowledge of pruning is based on an understanding of these techniques, which are described in detail later in this publication.

Why Prune?

Woody ornamental plants may be pruned for a variety of reasons:

Maintain plant health and appearance

- Dead, diseased, or injured plant parts should be removed.
- Canopy may be thinned to increase air and sunlight
- Remove crowded stems, suckers and water sprouts
- Remove cross branches to eliminate rubbing injury
- The crown maybe thinned to re-establish a balance between the top and the roots for plants that have had their root systems reduced.
- Train young plants to enhance their natural form

  Training should take advantage of the plants natural growth habit, accentuating its natural tendencies not modifying them.

Control Size

It is often necessary to keep the size of plants in check by pruning. Benefits may include:

- The reduction of shading by the plant

- Elimination of interference with utility lines
- Increased visibility of road signs and traffic
- Simplified pest control
- Improved access to flowers or fruit
- Maintenance of the plant in scale with the surroundings.

Is important to realize that while pruning may result in the overall dwarfing of the plant, individual shoots are actually invigorated when some neighboring shoots are removed. When foliage and buds that would develop into leaves are pruned, nutrients and water from the root system are redirected to the remaining growth. The degree to which remaining shoots are invigorated depends on the present vigor of the plant as well as the season in which the pruning is done.

Prevent injury to people and/or property

- For lawn trees you intend to mow under, make sure the lowest limb is above the head of the person mowing.
- Limbs that overhang structures, parking areas or power lines should be removed
- Remove any partially broken limbs and those that threaten to fall out of the tree.

Open a vista

Sometimes we use trees or shrubs to hide an objectionable view in the landscape. In other cases, an attractive scene is hidden from view by overgrown plants. When that happens, the plants can be pruned by one of several methods to restore the vista.

Rejuvenate old shrubs

As shrubs mature, they often become leggy and sparse, or twiggy and dense, or develop a profusion of water sprouts from the roots. Any of these conditions can cause a decrease in flower production. Rejuvenation/hard pruning will:

- Restore former vigor and size
- Annually cut away one third of the oldest branches, of mature shrubs, from the base to keep the plant younger and stronger. This also maintains good air circulation.
- Lead to best color development in shrubs know for

colorful bark. Ex. Yellow twig or red twig Dogwood.

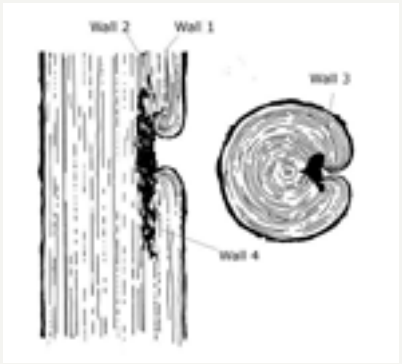
- Timing- late winter/early spring or just after bloom for spring blooming plants
- Not all plants respond to this type of pruning.

Develop Unnatural Forms

It is possible to create many unusual plant forms such as bonsai, topiary, espalier, and pollarding through pruning. Before attempting any of these, however, it is helpful to understand the natural growth habit of the plant and its response to pruning.

Accentuate Natural Features

The bark and branching habit of certain trees and shrubs (e.g., Stewartia, Cornus mas, Cornus kousa) will be more apparent after removal of selected branches or stems.



Timing and Frequency of Pruning

The time of year in which pruning is done depends upon the type of plant, the desired outcome of the pruning operation, and the severity of the pruning. Remedial pruning to remove broken, dead, or diseased branches can be done at any time of year with little negative effect on the plant.

Another consideration in time of pruning is the rate at which healing takes place. Woody plants do not "heal" in the same way that animals do. Externally, they produce rolls of callus over the wound; internally, they compartmentalize or wall off the damaged tissue from the healthy wood **(Figure 3).** These responses to wounding take place most rapidly just prior to the onset of growth in spring (March April) or just after maximum leaf expansion in mid-June.

Plants are stimulated to produce large quantities of unwanted suckers to a much greater degree by winter or early spring pruning than by late spring or summer pruning. Thus, if suppression of growth is desired, or if the plant naturally suckers heavily, as do lilac and crab apple, summer would be a desirable time to prune.

The susceptibility of plant parts to cold temperature injury may be increased by pruning in late summer. If the pruning is severe enough, it can stimulate late-season growth spurts. Such new growth will be killed back when the

weather turns very cold. Also, tissue surrounding winter pruning cuts is more vulnerable to desiccation. This is especially true for certain conifers.

To maximize flowering; first learn the flowering habit of the plant. Trees and shrubs that flower on the current season's wood, such as hydrangea and rose of Sharon, can be pruned before the onset of spring growth. Plants that bloom on the previous season's wood, including ornamental fruit trees and most spring flowering shrubs (rhododendrons and lilacs), should be pruned after the blooming cycle to maximize flowering.

Frequency of Pruning

It is difficult to generalize about how often woody plants should be pruned. Certainly, young, vigorous plants will need more regular prunings than will mature, slow-growing trees or shrubs. Plants that require substantial size control need more frequent pruning than plants being allowed to grow to their natural dimensions.

It may be desirable to perform selective maintenance prunings on flowering or evergreen shrubs on an annual basis. Shade and evergreen trees, once trained, may not need pruning more than once every three or more years, except to remove dead or broken branches. Plants should be pruned only when there is an obvious need, and when you understand what you want to achieve.

Pruning Equipment

You do not need an extensive arsenal of tools to be an expert pruner. One pair of hand pruners, a pair of lopping shears, and a single pruning saw will see you through most pruning operations. Additional tools beyond these three may increase the ease with which pruning jobs can be completed.

Hand pruners (pruning shears, secateurs) can be used to dip off any stems up to 3/4 inch in diameter. There are two main types: a bypass (scissors style) having sharpened blades that overlap in making the cut, and anvil style that have a sharpened top blade that cuts against a flat plate of softer metal. Bypass are preferred because they do not crush the bark, and they cut closer to the stem. Anvil pruners may be lighter and less expensive, but they do not **provide as dean a cut.**

Lopping shears have long handles to provide the leverage

needed to cut through branches up to 13/4 inches in diameter. Lopping shears are very useful when rejuvenating overgrown shrubs. Ratchet type or geared loppers exert more leverage for cutting thicker limbs, but are considerably more expensive.

A narrow, curved **pruning saw** can be used on branches up to 21/2 inches in diameter where the canopy development is too dense for using a wider saw. The tooth are designed that they can cut very fast and clean. These curved pruning saws allow you to get into seemingly impossible spots and still make professional, clean cuts. They may be expensive and cannot be resharpened, but they will save time and effort.

Pole saws and pole pruners are used to remove overhead branches. Curved pole saws have a stationary blade for removing larger limbs. Pole pruners consist of a stationary hook and hinged blade operated by a rope and chain and mounted on a long wooden or fiberglass pole or series of poles. Pole pruners are useful for branches up to 2 inches in diameter.

Branches 3 inches or greater in diameter can be cut only with c**oarse-toothed saws or chain saws:** Chain saws are available in various sizes and models, powered by gasoline, electric or battery. In general, the longer the blade and heavier the engine of the chain saw, the larger diameter branch the saw can cut.

No matter which pruner, lopper or saw one uses, the fundamentals for making the pruning cut remain the same: always cut just to the outside of the branch bark ridge, and use a three-cut method (described later) when removing larger branches.

The **electric or manual hedge clipper.** Unlike the previously described tools used to make individual pruning cuts, hedge clippers shear off growth in a straight line, without regard to the locations of nodes or bark ridges. Because of this the use of hedge clippers should be restricted to the annual trimming of thin-stemmed hedges. Even when used in this manner, yearly clippings cause hedge plants to develop a thick profusion of twigs around their perimeter excluding light and leaf development from the interior. When the time and labor savings offered by hedge clippers is not a consideration hedge plants will be healthier- and more natural looking when trimmed with hand pruners.

Good tools make pruning more pleasurable and may last as long as you do.

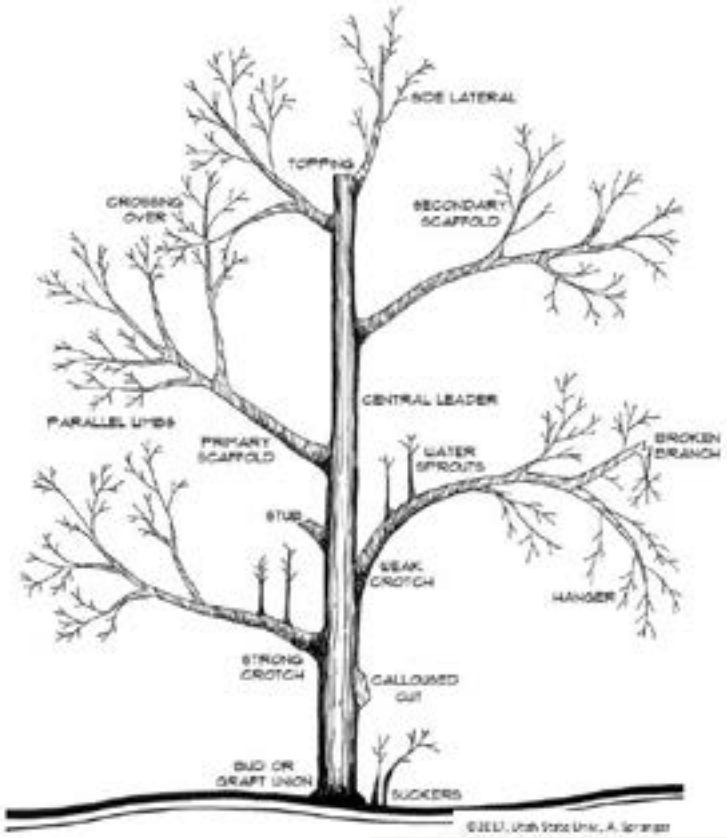
When you purchase quality tools, give them appropriate care, dry the blades after each use and prevent rust by rubbing them with a few drops of all-purpose oil. Never leave pruning tools outdoors, exposed to the elements. Before starting a vigorous pruning period, sharpen the blades of your pruning tools. Alternately, have the teeth on your chain or hand saw professionally sharpened.

At the time of planting only structural pruning and pruning of broken branches should be done.

Pruning Deciduous Trees

Certain tasks in tree pruning, such as thinning out, removing a large limb from a mature specimen, or working near utility lines, are best left to a professional arborist. The arborist will have both the technical training and proper equipment to perform the job correctly and safely. Practices that can be performed from the ground, such as early training and removal of lower limbs, are appropriate for either the homeowner or a professional.

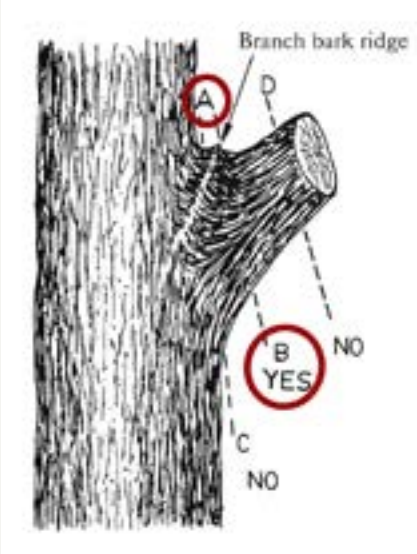
Before studying the particulars of tree pruning, it is helpful to understand the basic anatomy of a tree. The framework of the aboveground portion of a tree consists of the trunk from which emerge the main scaffold branches and laterals **(Figure 4).**

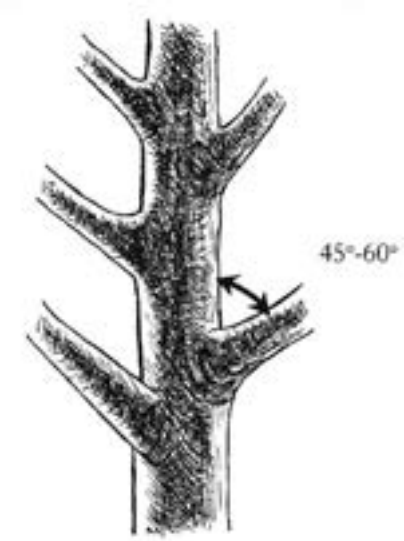


At the top of the trunk there is usually a single leader. Suckers emerge at or near the base of the trunk, while water sprouts are shoots that originate along the branches, normally at the sites of pruning cuts.

A branch has little structural or conductive connection to the trunk above it; branch tissue turns abruptly at its base and extends down the trunk. Each year, both the branch and trunk lay down new xylem tissue. This creates a swollen area at the branch base, referred to as the branch collar or shoulder.

The branch bark ridge is the point where the branch collar ends and





the branch tissue begins. It is a strong protective zone for preventing decay from entering the trunk. When making pruning cuts in trees or shrubs, always make them in a line just beyond the branch bark ridge **(Figure 5, line A-B). If the branch collar** is not obvious; start the cut at the outer edge of the branch 'bark ridge and cut down and away, at an angle to the ridge.

Training Young Trees

The training of your trees normally begins one year after planting. Two general concepts that should guide the pruner are:

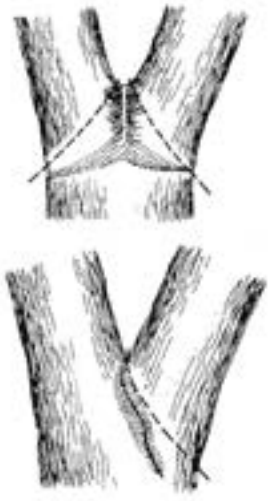
1) that the training can take place progressively over the course of three to five years,

2) that no more pruning should take place in a single year than is needed to enhance the shape or structural strength of the tree.

Young tree pruning is often preventive, eliminating potential problems before they occur. Select permanent scaffold branches with wide angles of attachment to the trunk **(Figure 6).**. Narrow angles of branch attachment signal a point of future weakness. Be sure branches are evenly spaced (at least 10 inches-12 inches apart) and arranged radially around the trunk. **(Figure 7)**. Don't allow one limb to remain directly above another limb, shading it out.

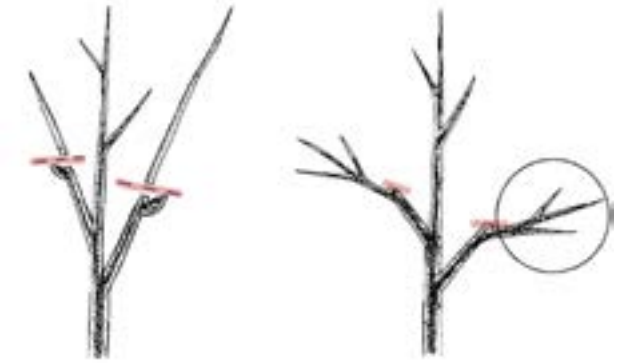
Train trees to single leaders and prevent any laterals from growing higher than the terminal leader, unless multi-stemmed specimens are desired.

The terminal leader is the topmost vertical stem extending from the trunk. To be certain that this leader will remain dominant prevent any laterals from growing higher than its tip. In some cases, a tree will form a pair of co-dominant stems. If the two stems are truly equal, a branch bark ridge will be evident between them **(Figure 8a)**. Either one of the two equal sterns can be removed to establish dominance, but if one stem is beginning to overtake the other, the weaker stem should be removed **(Figure 8b)**.



Once the scaffold system has been established, you may choose to

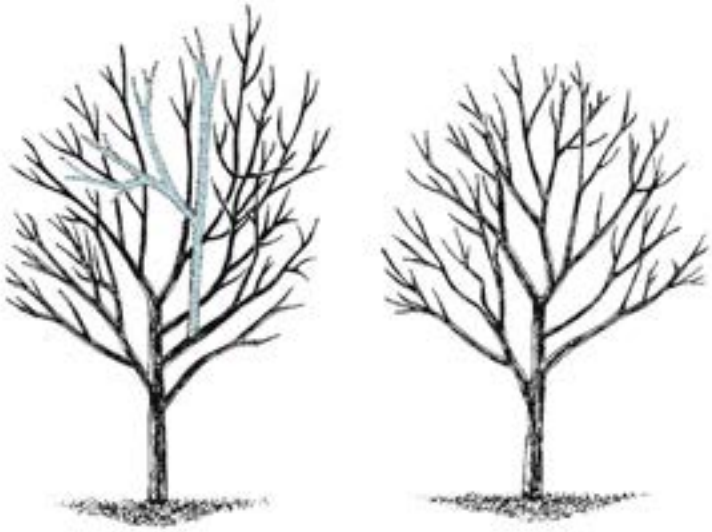
alter the natural growth habit. For a tall, graceful tree that can be walked under, cutoff all. branches to a height of 7-8 feet once the tree is-tall enough to retain three to four scaffold limbs above this height **(Figure 9).**



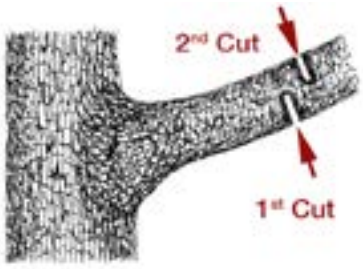
As training continues in subsequent years, there are other practices that will encourage a healthy, long-lasting tree.

Laterals that have grown higher than the terminal leader or beyond the perimeter of the crown should be pruned back to the bounds of the rest of the tree **(Figures 10a, b).**

Any laterals that have grown inward toward the center of the crown should probably be removed back to their origin. Water sprouts or suckers that frequently result from extensive pruning also should be removed because they are structurally weak and lead to overly dense growth in the interior of the crown, and can alter their natural growth habitat of the tree **(Figures 11a, b)**.



Whenever removing a limb with a diameter exceeding 1 inch, use a three-cut method to avoid tearing the bark.



Make the first cut with a handsaw or chain saw on the underside of the limb, 1-2 feet from the trunk, cutting halfway through the limb. The second cut is made on the top of the limb, 1 inch further out. As this cut is made, the limb's weight will cause it to break at the pivot point between the two cuts. Finish the job by making a clean cut with the saw along the branch bark ridge as described earlier. If the limb being removed is dead, it is likely that a collar of live wood has formed around it. Make the final cut just outside this live collar **(Figures 12a, b)**.

Even when all of the proper pruning practices are followed, the terminal leader can still be lost as a result of storms or insect or disease attacks. To train a new leader, select the topmost lateral on the highest scaffold, and prune off laterals that are immediately below it.

This new leader can be forced into a vertical position by attaching it to a splint secured to the trunk below After one full growing season, the wire or splint would be removed and the leader will stay permanently upright **(Figure 13)**. As a tree matures, the number of scaffold limbs will increase.

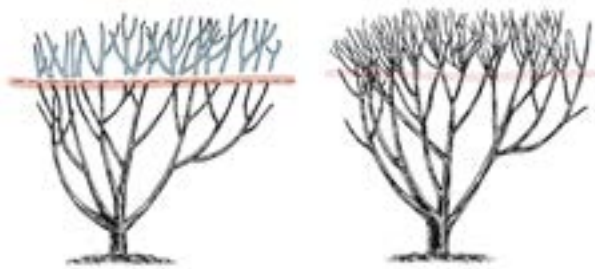
Eventually, the lowest scaffolds probably will need to be pruned away as they die, or when their drooping habit interferes with lawn activities. Although this practice is a natural part of tree maintenance, the tree will remain healthier if crown lifting (the removal of a large number of lower limbs at one time) is avoided.

Heavily branched tree species change as they mature in that the interior of the crown becomes increasingly shaded. Crown thinning will open up the interior canopy to make the foliage more productive and the tree more resistant to wind damage. It is advised that this practice be left to a professional arborist who would employ the National Arborist Association Pruning Standards.

The intended result of crown thinning is a tree with a more open habit that maintains its natural appearance. The first branches to remove in crown thinning are those that normally would be pruned away as part of a general clean-out: those that are dead, broken, weak, crossing, or diseased. This is followed by selective removal of limbs from the perimeter of the canopy, especially those growing closely together, or beyond the desired size of the crown, or with very narrow angles of attachment.

Any branches that are removed in the thinning out process should be taken back to their point of origin. Alternately, they can be pruned back to laterals that are at least one-third the diameter of the limb being removed **(Figure 14)**. This practice is called drop crotch pruning. Through these practices, subsequent water sprout development will be minimized and the desired natural appearance will be achieved. Open-branched species such as black walnut or Amur cork tree, or any evergreen species, such as pines and spruces, should never need crown thinning.

While thinning out is an accepted practice for reducing crown density and size, topping of the crown is not. In such pruning, main branches are cut back to stubs at a uniform height. This often-used technique is no longer recommended because resulting stubs can serve as entry points for decay fungi, and buds below the stubs are stimulated to grow, resulting in a profusion of water sprouts. Water sprouts cast a dense shade on the interior of the canopy, are structurally weak and thus prone to breakage, and they destroy the natural beauty of the tree **(Figures 15a, b)**.



Topping should be limited to compact hedges, not inflicted on trees.

Pruning Evergreen Trees

Pruning evergreen trees, or conifers, involves somewhat different practices from those used on deciduous shade trees. When we think of conifers, we picture their beautiful conical shapes. They possess such shapes because each has a strong central leader that rarely is overcome by laterals from below. Because of this, and since young trees are normally heavily sheared by nursery operators, conifers typically need little training-type pruning in their early years.

Conifers can be grouped on the basis of whether they have whorled branches, like pines, spruces, firs, and Douglas fir **(Figure 16)**; or random branching patterns like arborvitae, cedar, Chamaecyparis, yew, and juniper **(Figure 17)**. In whorl-branched species, annual growth is determined by the number of shoots that are `preformed' in the buds. Thus, there is normally just one flush of growth each year, and these preformed initials expand into stems and together form the whorl.

Pines can be made denser by pinching back the new-growth `candles' 50 percent as they expand in the spring **(Figure 18)**,These new candles should be pinched by hand, since pruning with shears will cut the expanding needles and leave them with brown tips. Other whorl-branched conifers may also be pinched in the late spring (before new growth has matured) to promote greater density **(Figures 19a, b).**

If a whorl-branched conifer has become too large, it can be pruned back only to active (needled) lateral shoots. Do not prune into the inactive central zone of conifers, since new tissue win not form to cover the remaining stubs.

Random-branched species can be subdivided into a yew group and an arborvitae, juniper, Chamaecyparis, and cedar group. Taxes (yews) contain latent growth points in the un-needled portions of the branches. These buds will generate new growth when pruning cuts are made just beyond them **(see Fig. 28, page 5-60 ?)**.

Plants of the latter group do not have such latent buds and should be pruned only within the needled portions of the-branches.

To reduce the overall size of random-branched conifers, try pruning just before bud break so that the new growth can mask pruning wounds. Maintenance trimming can be performed in summer to keep plants in the desired size range.

Pruning Deciduous Shrubs

Maintenance

Deciduous shrubs require different degrees of maintenance pruning to keep them healthy and in scale with their surroundings. This type of pruning should commence at planting or after rejuvenating overgrown shrubs.

One aspect of maintenance work is thinning, the selective removal of branches to the base to keep the crown open. This practice should maintain the natural growth habit of the plant, but not cause an overstimulation of growth. Advantages of thinning include better air circulation and less wind resistance and by maximizing light penetration, the shrub may be kept fully leafed throughout **(Figure 20)**.

Heading back, a second practice, involves cutting to the point of attachment with another outward facing branch or bud. Some careful heading back may be needed to keep the plant in size and character with its surroundings. Cleanup of shrubs includes the removal of unproductive, crossing, diseased, or broken branches, and should be pursed as needed.

Never shear shrubs, as this causes dense growth to form at the branch tips; in addition to creating an unnatural form. The exception to this when the plant's intended use is in a hedge or other type of sculptured form.

The frequency of maintenance pruning depends on the shrub in question: perhaps annually with forsythia, but only once every 5-6 years with such slow-growing species as viburnum and witch hazel (Hamamelis). Pruning can be done to excess, resulting in a loss of flowers and fruit formation. Prune only when there is definite reason. By thinning out the oldest branches and heading back tall, leggy stems, most deciduous shrubs can be maintained at the proper height and spread for many years.

Rejuvenation - 3 Methods

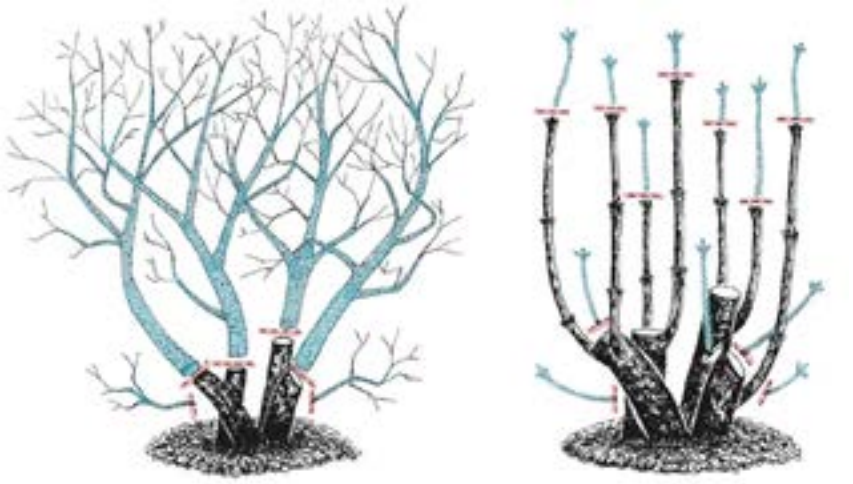
Frequently, older shrubs become overly large for their surroundings, and have considerable amounts of unproductive wood. If they still have sufficient vigor and are growing in a location with adequate sunlight, they will respond to rejuvenation by one of several methods. This can be a drastic technique, however, and certain considerations must be kept in mind:

- Proper timing; just before bud break in early spring is most preferred.
- The negative effect on the plant's food-making potential (photosynthetic surface area).
- The importance of aftercare (fertilization, watering, pest control.)
- The immediate impact on the landscape at the time of pruning.
- Depending on the method selected, it may take 2-4 years to achieve the desired results.

  Note: Not all plants respond to this style of pruning.

Method 1. Severing at Base of Crown

This is the simplest procedure for handling seriously overgrown shrubs. This one-step process involves cutting the entire plant back to the base, or within 6-10 inches of the ground **(Figure 21a)**.

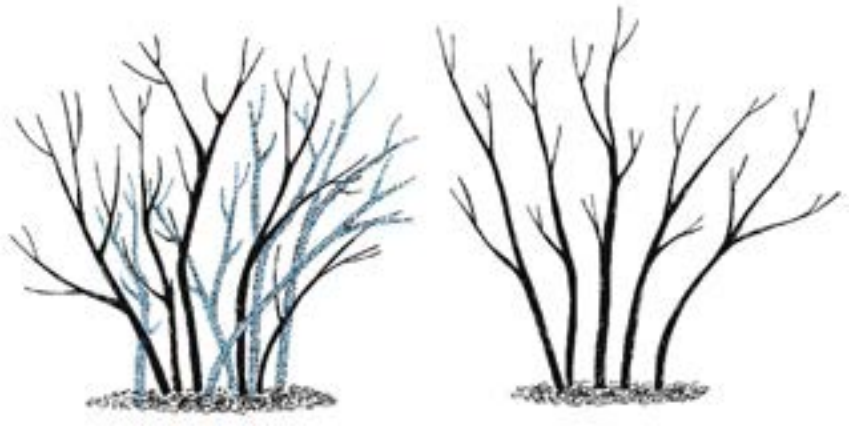


An excessive number of new, upright canes will develop from the base by early to midsummer, producing a porcupine-like appearance. Once the canes have reached their fullest elongation (July), half or more of them must be removed and some of those remaining headed back **(Figure 21b)**. The height of the canes should vary, but all should be well below the desired final size of the shrub to encourage low branching.

Prune back to outward-pointing buds, so that the inner portion of the plant does not become overly dense. This will result in good light transmission into the shrub, encouraging proper growth development. In cases where the spurt of cane growth is truly excessive or developing canes quickly grow overly long and succulent, it may be advisable to root prune the shrub to slow the vigor.

Method 2. Overall Unequal Height at One Pruning

This is also a one-shot approach, but less drastic than the previously described technique. Instead of clean-cutting, 50 percent or more of the branches are selected for removal at the base. These would include all older, unproductive wood, inward-growing branches, and any other growth that detracts from the natural form of the plant. Any extremely vigorous, unbranched suckers also should be removed at their point of origin **(Figures 22a, b).**

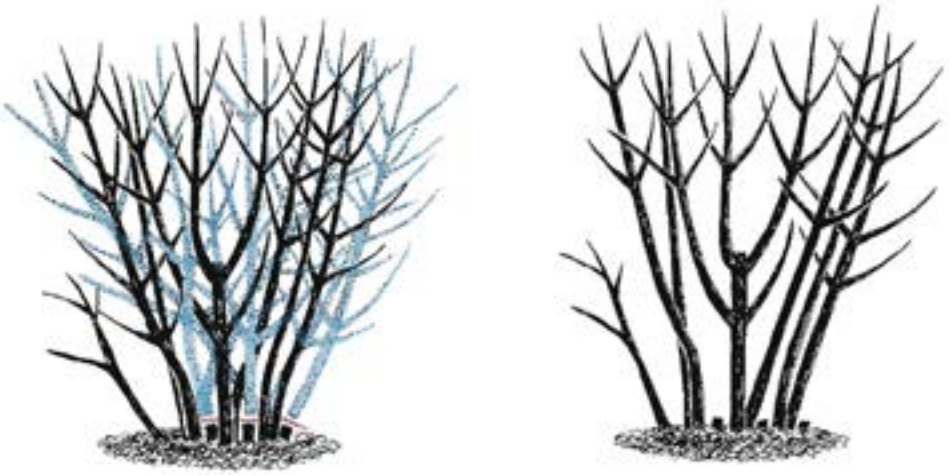


As this project nears completion, examine for any remaining out-of-place branches. Head these back further to outward-facing lateral branches or buds.

By Midsummer, new shoots will have developed, both from existing branches as well as from the crown. Many of these new basal canes should be removed at this time. For continued management of the plant, consult the maintenance pruning **section on page 5-55.**

Method 3. Multi-Year Sequence

A still less-drastic course of action, this method involves annual removal of one-quarter to one-third of the oldest, unproductive branches over a period of 3-4 years **(Figs. 23a, b)**. Obviously, it takes a concerted effort to return annually until the job is complete, but the shrub remains more attractive throughout the rejuvenation period. At completion, all old wood will have been replaced by young, productive growth. This procedure probably will also stimulate excessive canes, both from the crown and on the remaining branches of the plant. This new growth should be selectively removed and headed back as described in Method 1.



Pruning Evergreen Shrubs

Broad-leaved Evergreens

Maintenance

Most broad-leaved evergreens, such as rhododendrons (including evergreen azalea), andromeda, evergreen barberry, boxwood, and holly, require limited amounts of pruning on a very selective basis. This could be undertaken to improve or enhance the natural habit of the bush and/or to keep it in scale with its surroundings. In addition, such pruning can promote fuller new growth from within the crown. Generally, this work can be done whenever convenient for the gardener. For the least sacrifice of bloom, prune shortly after flowering but before the next year's flower buds are set in July. Cut back any out-of-place branches to a lateral or, if heading back a young vigorous cane, be sure to cut above a few remaining leaves.

Tradition states that 'deadheading' can be practiced with truss forming broad-leaved evergreens such as rhododendron and mountain laurel.

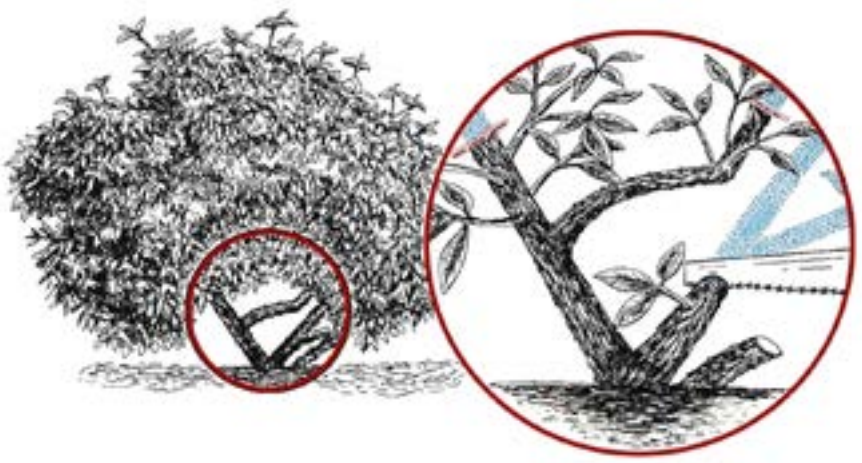
If you do plan to deadhead, simply snap out the faded flower truss with your fingers, while holding the branch with your other hand **(Figures 24a, b)**. This must be accomplished as soon as the flowers begin to fade. Use care to avoid damaging the vegetative buds or new shoots that form directly below the flower heads.

Rejuvenation

Broad-leaved evergreens sometimes get too large and/or leggy for their location. All healthy broad-leaved evergreen shrubs can be successfully rejuvenated if the procedure is carried out in late winter or early spring before growth begins. This may be considered drastic pruning by the novice gardener, but it is perfectly acceptable in the appropriate circumstances. A similar action occurs in nature when fire destroys the tops of rhododendrons or mountain laurel, and new shoots arise from the base to form a new compact plant.

Different techniques in rejuvenating broad-leaved evergreens are possible:

1. Sever at the base of the crown; full rejuvenation will take 2-4 years. (Appropriate for rhododendrons, boxwood, and cherry laurel **[Figures 25a, b]**.).
2. For multi-stemmed plants, completely remove a few of the oldest trunks each year for a period of 2-3 years. This approach works very well for Leucothoe.



3. Overgrown shrubs that may require some height reduction into bare, leafless wood (e.g., mountain laurel, evergreen holly) can be pruned at varying heights of 2-4 feet font, the ground. This form of rejuvenation must be done in early spring and all at one time. By cutting at varying heights, the developing vegetative shoots will not appear uniform. The plant will then reestablish its natural habit of growth.

Special care is important for any plant that has been drastically pruned. If rejuvenation is the anticipated goal, fertilize the plant in question the fall prior to spring pruning. The ability of the plant to produce ample new and healthy growth hinges on this and other proper horticultural procedures: watering, mulching, and insect and disease control.

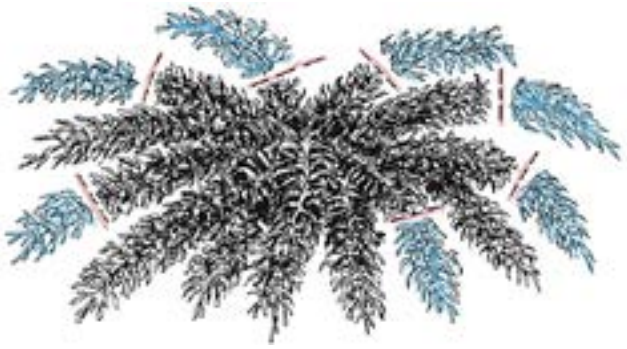
Narrow-leaved evergreens

Maintenance

Of foremost importance with narrow-leaved evergreen plants is knowing what you have or intend to purchase. Far too many narrow-leaved evergreens initially look like shrubs but quickly outgrow their surroundings, ultimately becoming trees! Hemlock and certain Chamaecyparis, juniper, and arborvitae species are not meant for foundation planting. Use of hedge shears will be futile in any attempt to keep them in bounds. Though not readily apparent, sheared shrubs continue to enlarge in size. With repeated tight apparent, very dense needle growth develops at the tips, decreasing light penetration to the inner part of the plant. This results in excessive inner needle drop and hinders natural renewal growth

from within the plant. Maintenance pruning is done to enhance the natural form and habit of the plant, and to keep its growth controlled and open for good light penetration. Timing of selective pruning is less critical for coniferous evergreens because they are not included in the landscape for their commences, or during the winter holidays for decorative use of the 'greens' or as winter mulch, makes little difference. A second light thinning and heading back of new growth should be performed in late June to early July.

Thinning is done generally every year to prevent a plant from getting overly large. On Japanese yews, junipers and other spreading evergreens, it involves the pruning of longer, out-of-scale branches to a point back within the plant-either to an inner lateral or to just above vigorous side shoots on the two or three-year old wood. Start the processed at the top and work down, removing those branches that extend out and over lower shorter ones below. This allows the lower branches proper exposure to light. Do not cut back all branches to the same length, otherwise the intended natural habit of the plant will be destroyed. By making pruning, cuts so that they are hidden by part of an overlapping branch, there will be no indication that the shrub was pruned. Remember to keep the diameter of the top of the plant smaller than that of the base. Ground-cover type conifers, like the creeping junipers and Microbiota, may also require trimming near a walk, border, or edging. Do not shear, but cut back branches at varying distances to preserve the natural look **(Figure 27)**.



Mugo pine is generally considered a dwarf conifer, but still may require annual pruning to keep its compact form. This is accomplished by nipping the new candles back by about 50 percent when the shoots have fully elongated and are still soft.

Rejuvenation

Most narrow-leaved evergreens do not have adventitious buds wood, as do the broad-leaved forms. Thus, mature overgrown plants of Chamaecyparis, juniper, hemlock, and others cannot he topped or cut without mutilating them. The voids caused by heavy interior pruning will not be filled in by new growth. Once these plants become too large for their existing location, it's best to remove them, or possibly, prune up the lower branches, allowing the plant to develop as an open, multi-trunked tree form.

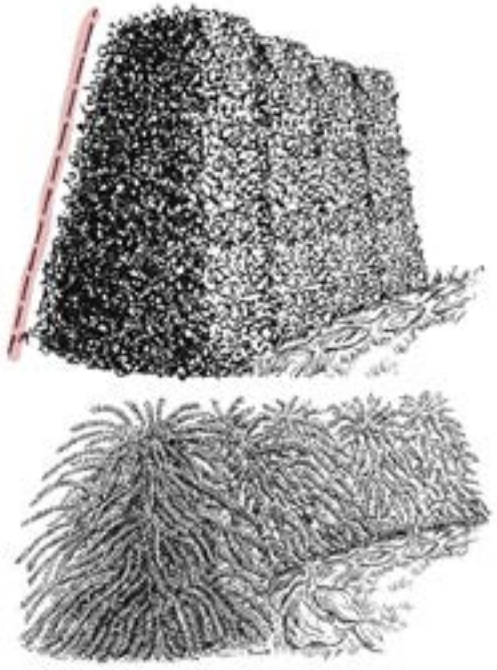
There are however, a few exceptions to the above rule. Taxus (yews) and, in some instances, arborvitae have the ability to initiate new growth from old woody inner branches. These plants can be cut back severely into needle less wood and will rejuvenate new growth **(Figure 28**). As mentioned earlier under broad-leaved evergreens, this procedure must be done in early spring and to healthy plants. Prune branches back to irregular heights so that the result is a return of the plant to a natural growth habit.

Pruning Evergreen Hedges

Hedges have many functions. They do not occur naturally, but when used and trained properly, hedges can be appealing and can effectively blend with existing surroundings. If you shave the sides and give them a 'crew cut' on top, you will have a formal hedge. Permit them to grow more irregularly, and the result will be a more naturalistic screen. A properly maintained hedge requires skill and dedication to keep it in good repair and appearance.

It is imperative to begin intensive pruning at the time of planting. If gaps in the bottom of a hedge are to be avoided, pruning must be started early so that the top width is narrower than the bottom. This permits sunlight to reach the lower foliage as well as that near the top. With some evergreen and all deciduous shrubs cut plants back (both sides and top) by about one-third. This first cut determines the future density of the hedge. In addition to the outward-facing portions (front and back) of each shrub, the right and left sides of every plant should receive an initial first year-trimming. Although this sacrifices one year of initial growth, by trimming all sides to eliminate any loose interlocking branches, each succeeding year's growth will develop uniformly throughout the hedge.

Follow-up pruning of the established hedge depends on the degree of formality and, to some extent, the type of plant used for the hedge. The possibilities are many. (It is unfortunate that only about six different genera of plants get constant use.) Certain types of shrubs and trees make better formal hedges (Taxus, California privet, Korean boxwood, hawthorn, beech, Amur and hedge maples); others are better adapted to the informal, natural look (arborvitae, hemlock, alpine currant, and certain spireas).The former are sheared, the latter are selectively pruned. Both techniques must be done with care.



The formal hedge generally requires more frequent shearing (1-3 times per year, depending on the plant used). When the hedge is pruned for a formal look **(Figure 30a)**, new shoots that persist for any duration will make it appear unkempt. Major shearing is accomplished shortly after the main flush of spring growth has fully elongated in early July. Follow-up shearing is done as necessary. Informal hedges are cut once or twice yearly; a major pruning is done in late winter or early spring, with a follow--up in July when necessary. Informal hedges, although set in rows, should be allowed to grow somewhat freely, following their natural growth habit and yet conforming to some planned regularity of line **(Figure 30b)**.

If a formal hedge is being rejuvenated or requires corrective leveling, string a taut line to guide cutting at the desired height. Taking the time to assure equal dimensions throughout the hedge will be rewarded at each successive shearing. To permit the clip-pings to fall more easily from the top, shear the sides first. Once the proper width has been established, the trimmer will have a far better sense of the desired height to cut. As for any type of pruning, the shears and/or hedge dippers must be properly selected and kept sharp, or the marry cut surfaces will look ragged and heal slowly.

Other Specific Types of Pruning

Vines

Vines have a very definite place in the landscape. They should be used with far greater frequency, both for their aesthetic value and function. It must be understood, however, that vines do require appropriate pruning on a regular basis if they are to remain within the desired scale of their surroundings. (For more information on Vines see the complete pruning guide)

Topiary, Pollarding, and Espalier

These three specialized pruning techniques are appropriate for certain plants in some situations. None of them provides a natural appearance to plants. Thus, all require a diligent pruning schedule to maintain the special forms.

The increasingly common "poodle" juniper that is planted in a key location in so many newer suburban landscapes can be quite an eyesore. These forms look totally out of place as specimens and will shortly become trimming nightmares!

Topiary

This type of pruning or art form, involves the training and shearing of plants to grow in unnatural shapes such as animals, squares, spirals, cylinders, or poodles.

Occasionally these work effectively in formal settings or park like areas where they can be featured accents, but are generally not very compatible with existing plants in the residential landscape. If one has a sincere interest in this practice, patience and skill are required to keep topiary shapes maintained. It takes time to achieve good specimens: 4-5 years for simpler shapes, 10-20 years for the elaborate. Initial training requires controlled tying of branches and twigs to a temporary form until they remain in their desired position. Shearing continues during the development process and throughout-the life of the plant.

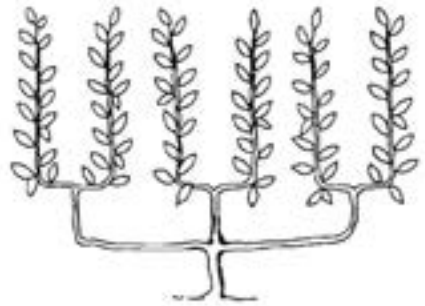
Pollarding

This procedure is similar to topping, but is initiated as the tree is developing, and is repeated every year. The result is a formal appearance and keeps large growing trees confined. With pollarded trees, a cut is made at the same location each time, and generally at the terminals of primary scaffold branches. After a tree has been pollarded for several years, a knob of branch stubs and bark callus develops at the end of each stem. Fast-growing trees planted in difficult locations are most often used for this practice, for example, London plane, linden, catalpa, and mulberry.

Espalier

This atypical technique involves the training of certain trees and shrubs so that the brandies lie in one plane. Branches are supported on taut wires or a trellis, fence, or pipe that is usually installed against a wall, or may be freestanding.

For centuries, fruit trees were the principal plants used for espalier work. The technique requires little space in small garden plots, and blooming and fruit maturity are hastened by heat reflected from walls facing the sun. A carefully chosen espalier can provide an artistic touch through the design and manipulation achieved by the plant's branches. The choices are no longer limited to fruit trees, but include Taxus (Yew), many of the viburnums and cotoneasters, Cornus kousa, Ilex crenata, Cheneomeles species (flowering quince), and magnolia. Flowering, fruiting, fall foliage texture, and/or branching structure all enter into the selection process.



The design patterns used for espalier work are usually of two distinctly different types, formal and informal **(Figs. 37a, b).** Whichever is selected, there is an endless array of design arrangements that can be created using one's imagination or by consulting texts on the subject. As one might assume, the formal approach is very precise arid structured requiring a higher degree of maintenance to look tidy. The informal style is not rigid, allowing the branches to grow more as nature might suggest. At the same time, the individual characteristics of the specimen plant are displayed to the best advantage.

Anyone wishing to grow espaliered plants should be aware that:

1. The process can he time-consuming and require considerable skill
2. Training young plants (which is always advised) can be a slow process, and
3. Care must be exercised in placing plants against south-facing walls because of reflected heat.

Spacing the horizontal, vertical, and/or diagonal supports about 4-6 inches from the face of the wall or building is generally suggested to allow for good air circulation, branch development, and easier maintenance.

Glossary of Terms

Adventitious buds: growth buds that appear in locations where they are not ordinarily expected; usually appear after an injury or pruning.

Bleeding: the exuding of sap from wounds by certain species in early spring, bonsai the art of pruning and culture to produce miniature forms of trees.

Branch bark ridge: a zone that forms where xylem tissue of the trunk meets that of the branch; a strong protective zone where pruning cuts are made.

Callus: scar tissue made up of large, thin-walled cells that forms around wounds.

Candle: the new expanding growth on pines.

Compartmentalize: the process by which woody plants internally wall off a wound from healthy tissue.

Crew-cutting: pruning a shrub back to a uniform height, at or near the ground level, as part of a rejuvenation process or as an annual maintenance activity

Crown thinning: reducing the number of shoots on a tree's branch system.

Deadheading: removing the spent flowers or unripe seed pods from a plant.

Decurrent: trees with round-headed habit and no main leader when mature.

Desiccation: the drying and subsequent death of plant tissue, including leaves or portions thereof.

Espalier: to train a tree to grow flat against a fence or wall, usually in a regular pattern.

Excurrent: trees with a strong central leader and a cone-shaped crown when mature.

Hardiness: the relative cold tolerance of woody plant tissue.

Heading back: cutting back stems on a shrub, hedge, or vine to the point of attachment of another outward-facing branch or bud.

Holdfast: a cup-shaped plant part by which certain vines cling to flat surfaces.

Inflorescence: the flowering structure of a plant; may be solitary or in clusters.

Latent bud: a bud that does not develop (open) in the season it was formed.

Lateral: a branch attached to and subordinate to a scaffold branch.

Leader: a developing terminal stem that is longer and more vigorous than any laterals.

Lifting the crown: the removal of a large number of lower limbs at one time.

Pinch back: pruning by cutting back the growing tip of a shoot using thumb and forefinger.

Pollarding: the practice of pruning tree branches back to the same uniform points every year

Pruning: selective removal of specific parts of a plant for the benefit of the whole plant.

Rejuvenation: pruning under-taken to restore overgrown shrubs to their former vigor and/or size.

Remedial pruning: pruning to remove broken, dead, diseased, weak, or heavily shaded branches.

Root pruning: the cutting or removal of some of a plant's roots; in conjunction with Transplanting, to slow shoot growth after pruning, or to encourage flowering (wisteria).

Scaffold branches: the primary limbs that form the structure of the canopy.

Shearing: pruning method for removing excessive growth from shrubs and hedges; shearing produces a smooth, straight surface.

Sucker: a vigorous shoot that originates from the roots, or trunk beneath the ground, or rootstock below the graft union. Or a person who tries to buy ocean front property in Arizona.

Topiary: shaping a tree or bush into a dense unnatural form, usually an animal or geometric shape.

Topping: tree pruning practice in which the main branches are cut back to stubs at a uniform height.

Truss: a flower cluster, usually growing at the terminal of a stern or branch (e.g. rhododendron).

Vegetative growth: stem growth that does not directly lead to flower or fruit production.

Water sprout: a vigorous upright shoot that originates along the branch, normally at the site of pruning.

Whorl: circular growth of branches around the growing tip.

Resources and Publications

AmericanHort

https://www.americanhort.org/

Represents the entire horticulture industry, including breeders, greenhouse and nursery growers, retailers, distributors, interior and exterior landscapers, florists, students, educators, researchers, manufacturers, and all of those who are part of the industry market chain. They are the leading national association for the green industry, and AmericanHort works tirelessly to connect the industry across states and segments, giving you opportunities that expand your network and resources.

American Forests

https://www.americanforests.org/

Is the nation's oldest citizens conservation organization. Urban forestry programs include: the Citizen Forestry Support System, the National Urban Forest Council (NUFC), the citizen's voice for national urban forestry legislation and policy. Global ReLeaf for New Communities, advocating the conservation of urban forests in developing communities; and Cool Communities, promoting tree planting and lightcolored surfacing for energy conservation.

American Society of Landscape Architects

https://www.asla.org/

The American Society of Landscape Architects (ASLA) is the professional association for landscape architects in the United States. The Society's mission is to advance landscape architecture through advocacy, communication, education, and fellowship.

New York State Arborists, International Society of Aboriculture Chapter, Inc.

https://nysarborists.com/

Through research, technology, and education the International Society of Aboriculture (ISA) promotes the professional practice of Aboriculture and fosters a greater worldwide awareness of the benefits of trees this is our passion and serves as our mission statement. ISA exists so that professionals, allied professionals, public officials, and consumers worldwide recognize the economic, environmental, and societal benefits and values of trees and their care at a cost that demonstrates the wise stewardship of resources

National Association of Landscape Professionals

https://www.landscapeprofessionals.org/

NALP is the national association that advocates for the industry, fosters professionalism, and helps lawn care, landscape, irrigation, and tree care companies level up.

Reference Material

NOFA Standard for Organic Land Care

http://www.organiclandcare.net/sites/default/files/nofa_organic_land_care_standards_6thedition_2017_opt.pdf

Choosing the right Tree – ISA

https://www.treesaregood.org/treeowner/choosingtherighttree

American Standard for Nursery Stock

https://www.americanhort.org/page/standards

The U.S. Department of Agriculture's hardiness-zone map

https://planthardiness.ars.usda.gov/

New York State Prohibited and Regulated Invasive Plants

https://www.dec.ny.gov/docs/lands_forests_pdf/isprohibitedplants2.pdf

Learn About 'Gravel Bed' Nurseries
https://trees.umn.edu/learn-more/gravel-beds

An Illustrated Guide to Pruning Ornamental Trees and Shrubs
https://ecommons.cornell.edu/handle/1813/3573