

Landscape Design and Horticulture

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Landscape Design Basics

Landscape design can be defined as organizing and enriching outdoor space by placing plants and structures in an agreeable and useful relationship with the natural environment.

Designing landscapes is an art. Merely planting trees and shrubs is not landscaping. Landscaping is creating a plan to make the best use of available space in the most attractive way. It means shaping the land to make the most of a site's natural features and advantages, and it includes building such necessary structures as fences, walls and patios. Finally, landscaping involves selecting and growing plants that best fit the design.

The smaller the house, grounds and budget, the greater the need for effective and complete planning because every square foot of space and every dollar must produce maximum results. Plan for the best use of the site and minimum upkeep as well as a pleasant appearance.

Plan for complete development. There is no need to develop all of the lot at once. However, there should be an overall plan so that when any work is done on the lot, it will be part of the general scheme. Carrying out the landscape plan generally takes several years, since plants need time to grow. Do not allow a spade of earth to be turned until a grading schedule has been prepared from a well-studied plan for house and lot. To do otherwise is to sacrifice other things, such as valuable trees and soil.

Analysis of Site and Family Needs

The fundamental principle of landscape design is that each development should be based upon a specific program. In turn, this program should be based upon the following criteria: the people who will use it, their cultural needs, individual desires and economic

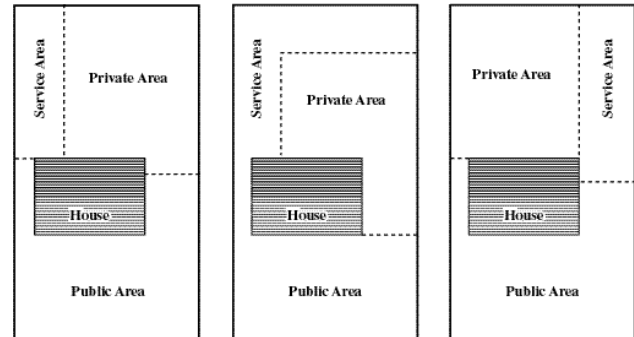


Figure 1. Division of landscape into use areas.

abilities; the climate; the site, its immediate surroundings, its topographic and ecological conditions and all objects, natural or manmade, that now exist on the site or are planned for the future; and the available materials fabrication methods.

The landscape designer must study the habits of people and what they do and understand their desires and needs. The landscape designer also must determine what space and materials are available and how they may be used to accommodate these goals.

The first step in landscape design is to divide the available space into use areas, including the public area, the private area, and the service or work area (fig.1). The public area is the section seen by passersby. It is generally in front of the house and should present an attractive public view. The living or private area is for the family and may consist of a patio, deck or porch for outdoor sitting, entertaining or dining. A play area may be incorporated into the living area, depending on the family's interest and the ages of any children. A service or storage and work area should provide a place for garbage, garden tools, supplies, etc. It should have convenient access and may be screened from other areas. A cut flower bed or vegetable garden may be conveniently located in or near the service area.

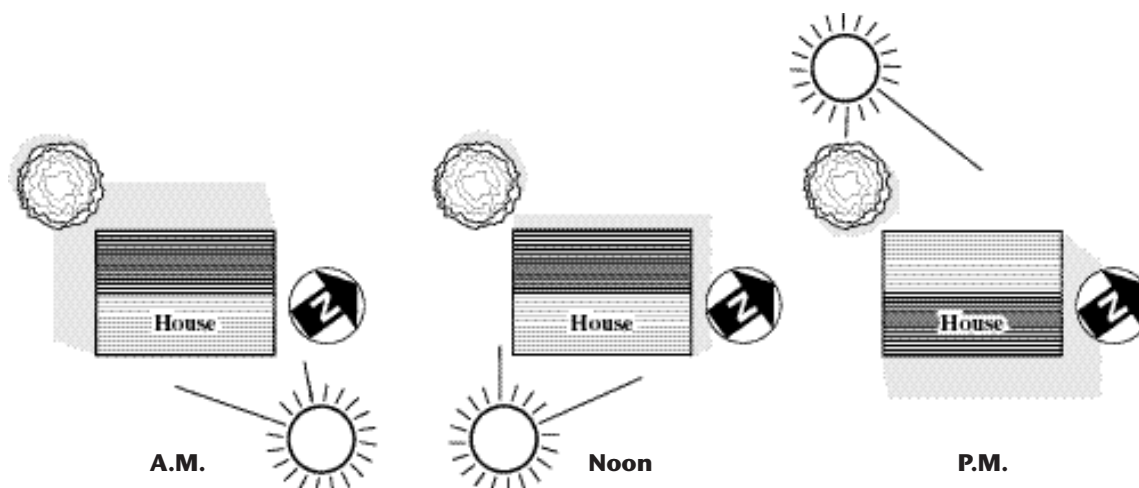


Figure 2. Shade patterns at different times of day.

Factors Influencing Landscape Design

The Lot and Its Characteristics

In planning a design, preserve the best natural resources on the site, such as mature trees, ponds, brooks, rock outcroppings, good soil, turf, and interesting variations in the terrain. These natural elements affect the ease of construction and contribute to the overall landscape possibilities. Carefully survey the area to determine whether site conditions will be a deterrent or whether they can be incorporated into a design plan. Thin, overcrowded trees may be a problem and should be removed. Microenvironmental problems may exist on a site, such as low places with cold air drainage or areas with poor soil and inadequate water drainage.

Changes in elevation can add interest and variety to the home landscape. The character of land and its hills, slope, and trees should determine the basic landscape pattern. A hilly, wooded lot lends itself to an informal or natural design with large areas left in their natural state. In such a setting, large trees can be retained.

Although natural slope variations are an asset, avoid creating too many artificial slopes. Excessive grading of terraces or retaining walls should be avoided. If these features are necessary to facilitate construction or control water drainage, they should be designed to detract as little as possible from the natural terrain.

Neighborhood Sights and Sounds

Keep attractive views visible and screen undesirable views. A shrub or two often will provide necessary screening. Plants also can act as noise barriers. Principal rooms of the house should look out on the lawn or the garden. Design special areas to be viewed from favorite windows.

Climate

Climate includes sunlight, wind, temperature, and all forms of precipitation. Climate affects the way a house should be placed on a lot, how the land is used and what is planted. In planning the grounds, do not fight the climate. Instead, capitalize on its advantages. In warm regions, enlarge the outdoor living area. In cold regions, plan the landscape so that winter scenes are enjoyed from indoors. Evergreens and hedges are picturesque when covered with snow. Since people respond differently to sun and shade, it also is important to study the amount and location of each on the lot. Sun and shade patterns change with the seasons and vary each minute of the day (fig. 2). The sun is higher, and shadows are shorter in summer than in winter.

Northern exposures receive the least light and are therefore the coolest. Eastern and western areas receive more light; western exposures are warmer than eastern because they receive afternoon light. Southern orientations receive the most light and tend to be warmest.

The principal rooms of a house should benefit from winter sun and summer breeze. This means that the house must be correctly oriented. A plan suited to one lot will not be correct for another lot that faces a different direction. Sunlight and shade can be controlled by the location of buildings, fences, and trees. Also, consider possible shade from trees and houses on neighboring lots.

Plan future shade from tree plantings with great care in order to keep sunny areas for the garden and summer shade for the house and terrace. Deciduous trees (those that shed their leaves) shade the house in summer and admit the sun in winter. Place trees off the corners rather than the sides of the house, where they will accent the house and not block views and air circulation from windows. Remember that too many trees tend to shut out sunlight and air.

Family Activities

How the land is going to be used should be a determining factor in landscape design. Analyze family activities. For example, small children need an open lawn for playing, and gardeners need space for growing vegetables and flowers. Make allowances for future changes. Consider outdoor living, playing, gardening, and household servicing. Family routines follow a general pattern, but they vary with each family's way of living.

Cost Effective Maintenance

Decide on maintenance standards. For the person who enjoys puttering about the yard, landscape design may be elaborate. In general, the simpler the site, the less there is to maintain. A low maintenance plan is the goal of most homeowners. This may be achieved to a large extent in the planning stage by careful attention to the nature of the site. Existing trees, elevations, and projected use of the area should be prime considerations. Low maintenance may be achieved by adopting one or more of the following:

- Have small lawn areas
- Use ground covers or natural pine straw, bark chips and other mulches
- Pave heavily traveled areas
- Provide brick or concrete mowing strips for flower beds and shrub borders
- Use fences or walls instead of clipped formal hedges for screening
- Design raised flower beds for easy access and to help control weeds

- Install an underground irrigation system in areas of low rainfall
- Have small flower beds and use flowering trees and shrubs for color
- Be selective in the choice of plant materials; some plants require little pruning, spraying, and watering
- Use native plant materials
- Keep the design simple
- Use mulches for weed control when possible.
- If herbicides are necessary, use caution and follow directions

Definition of Areas and Design Considerations

The residential landscape can be divided into three areas: public, private, and service.

Public Area

This is the area the public sees, which generally is in front facing the street. The landscape in this area should create an illusion of spaciousness. Tall trees in the backyard and medium-sized trees on the sides and in front will help accomplish this effect. Keep the lawn open and keep shrubs to the side or in foundation plantings. When selecting shrubs to frame the front door, consider their texture, color, size, and shape, so they will enhance the total effect of welcoming guests. The house is to be the focal point of the view.

Driveways should be pleasing in appearance, useful, and safe. The landscaping of many homes is spoiled by poorly designed and maintained driveways. Some driveways tend to unnecessarily cut up the yard. Parking areas and turnabouts should be provided when practical. If possible, the driveway should be hard-surfaced, because it is neater and requires less maintenance than unpaved driveways. Do not plant tall shrubbery at a driveway entrance or allow vegetation to grow so tall that it obstructs the view of the roadway in either direction.

In planning the home grounds, give careful consideration to foot traffic patterns, so there will be easy access from one area to another. This traffic may be served by walkways, terraces, or open stretches of lawn. In areas of heavy use, a paved surface is best.

The walkway design to the front door often depends on the location of the front door relative to parking and the topography of the land. When guest parking is at the edge of the street, a straight walk is probably

best if the grade is suitable. When the guest parking area is planned for the property, the walk might more logically lead from the guest parking area to the front door. Foot traffic can use the driveway.

Sometimes land topography makes it desirable to have the entrance walkway start at the edge of the property and curve to the front door to take advantage of a gradual grade. However, avoid curved walks that have no apparent reason for curving.

Generally, the walkway to the front door parallels the house and joins the driveway. This design is sometimes used if the driveway entrance grade at the street is less steep than the area directly in front of the door. This type of design might eliminate the need for stairs. When the walkway is parallel to the house, be sure sufficient space is left for plant material.

For a residence, make the front walkway at least 4 feet wide. Build safe walkways. Avoid using of materials that are rough or raised that can cause visitors to trip or stumble. Design steps so they will be safe, especially in wet or icy weather. Make the treads wider and the risers less tall than the treads and risers used indoors. Install handrails where needed.

Private or Outdoor Living Area

The private living area or outdoor living room has become an important part of American homes. No yard is too small to have a private sitting area where family and guests can gather. Where possible, there should be easy access from the house to the outdoor area. The ideal arrangement is to have the living room open onto a porch or terrace and have the kitchen near the outdoor dining area. The outdoor living room can be simple. An open, grassy area enclosed by a wall or shrubs enables the homeowner and guests to sit outdoors in private. Alternatively, a more elaborate outdoor living room can be developed by introducing a series of gardens or garden features.

The outdoor private area serves the following functions: outdoor entertaining, family relaxation, recreation, outdoor eating, and aesthetic enjoyment.

When planning major private areas, several factors should be considered.

Privacy

The area should be screened from public view or nearby neighbors using properly grouped shrub borders or

trees. For a small area, use a fence to save space. The private area should be screened from work areas, such as clotheslines, wood piles, garden sheds or other less pleasant views.

Livable Touch

Furniture should be attractive, designed for outdoor use and appropriate for the size of the landscaping. Garden accessories should be kept to a minimum and should be simple and unobtrusive.

Year-Round Interest

The outdoor living area should be planned so that the plant material is varied, and there is interest throughout the year. This is especially true if the area is visible from the house. For winter interest, select shrubs and trees with colorful bark, evergreen foliage, or colorful fruit. During the rest of the year, use flowers, shrubs, and trees to create interest. Pools, stone steps, paving, walls, birdfeeders, and other architectural features will add interest to the garden. Architectural details do not change with the seasons and can give interest and meaning to the garden throughout the year.

Climate Control

Control of climate in the outdoor living area helps extend its period of usefulness. Shade trees screen the area from hot sun, and windbreaks reduce some of the wind in the spring. An awning or trellis-type roof can provide shade or shelter from rain. A garden pool or fountain conveys coolness during the hot summer season.

The Terrace or Sitting Area

The center of activity for a living area often is a space arranged with garden or patio furniture. It may be a porch, deck, or terrace next to the house or a special section of the living area. It may be under the shade of a large tree or in a shady corner. The sitting center may be either paved or in turf. Flagstone, brick, concrete blocks, or concrete with redwood dividers are materials commonly used for surfacing the outdoor terrace. The size of the paved terrace depends upon its expected use and the type and amount of furniture. A 10- by 10-foot area will hold four chairs and is about the minimum size to comfortably accommodate four people. Increase the size if space is desired for a picnic table and a grouping of four to eight chairs. This area also may include a grill or outdoor cooking area.

The Play Area

The play area can be part of the outdoor living area, or it can be separate from it. For very young children, a small area enclosed by a fence near the kitchen or living area is desirable. A swing, sand box, or other playing equipment can be placed here. In yards with a good deal of open lawn space, there is room for croquet, badminton, or a portable wading pool. A large tree in the backyard may be ideal for a tree house. A paved driveway or parking area makes an ideal area for badminton, basketball, or shuffleboard for older children, as well as tricycling or roller skating for younger ones. Since children's ages and interests always are changing, it is necessary to make design adjustments to meet changing recreational needs.

Enclosed Front Yard as a Private Area

The front yard of most homes is traditionally left open so that the home can be viewed by passersby. However, privacy for the front area can be provided by hedges or a screen of trees and shrubs along the street. For example, privacy in the front yard may be desired if a picture window faces the street or if the front yard is used for outdoor sitting. Where space is limited, a tall fence may provide privacy and may be an attractive background for shrubs and smaller plants. Check city codes and ordinances. Tall front yard fences may not be allowed without a variance.

Service, Work or Production Areas

Space often needs to be provided for permanent clotheslines, garbage cans, trash burners, air-conditioner units, tool storage, wood storage, a vegetable garden, compost bin or pile, a cutting garden, propagating structures, small greenhouses, or a kennel. Service facilities should not be visible from the outdoor living area or from the street. However, an exception might be an attractive greenhouse or storage building designed and constructed so that it blends into the overall setting and has an interesting composition of plants around it. Wood or wire fences, brick or masonry walls, plant material alone or a combination of these elements are used most commonly to hide or partially screen service areas.

In a small backyard, it may not be feasible to completely enclose a permanent clothesline. Hiding poles with one or two large shrubs or using a vine-covered trellis will make them less noticeable. Portable clotheslines are a solution, if there is not enough space for permanent drying areas. When possible, the perma-

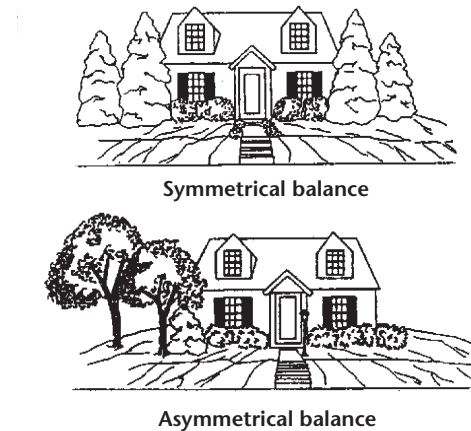


Figure 3. Examples of balance.

nent or portable drying areas should be located near the laundry center so that wet clothes won't need to be carried far.

Principles of Design

There are no hard and fast rules for landscaping, since each design is a unique creation. As in all art forms, landscaping is based on certain principles of design. These principles are discussed below.

Scale

Scale refers to the proportion between two sets of dimensions. Knowing the eventual or mature size of a plant is critical when locating it near a building. Plants that grow too large will overwhelm a building. Small plantings around a large building may be similarly inappropriate. It is essential, therefore, to know the final size of a particular plant before using it in a landscape. Both the mature height and spread of a plant should be considered.

Balance

Balance in landscaping refers to an aesthetically pleasing integration of elements in the landscape. It is a sense of one part being of equal visual weight or mass to another. There are two types of balance, symmetrical and asymmetrical (fig. 3). Symmetrical balance is formal balance. It has an axis with everything on one side being duplicated or mirrored on the other side. Asymmetrical balance is achieved by using different objects to achieve equilibrium. For example, if there is a very large object on one side of a seesaw, it can be counterbalanced on the other side by using many



Figure 4. Example of accent.

smaller objects or one object of equal size. In each instance, balance is achieved. This applies to landscaping when there is a large existing tree or shrub. To achieve visual equilibrium, a grouping or cluster of smaller plants is used to counterbalance the large existing plant. Balance also may be achieved by using color and texture.

Unity

A garden with too many ideas expressed in a limited area lacks unity. Too many showy plants or too many accessories on the lawn claim more attention than the house itself. Using too many accent plants or plants with contrasting textures, forms, or colors violates the principles of unity. In order to achieve unity, it is necessary to group or arrange different parts of the design to appear as a single unit. The design should present a pleasant picture from every angle.

Rhythm

Rhythm is the repetition of elements that directs the eye through the design. Rhythm results only when elements appear in regular measures and in a definite direction. Rhythm is expressed in color as well as form.

Simplicity

Every square foot of landscape does not have to have something in it. Objects, such as bird baths or plastic yellow daisies, often are overused in the landscape. One design concept states that “less is more,” and this is especially true regarding landscape design. Keep the landscape simple, and it will look its best. Avoid cluttering the yard with unnecessary objects. This includes plant material, statuary and miscellaneous



Figure 5. Example of repetition.

objects. When too many extras are introduced, the yard looks messy. Use statuary or specimen plants with discretion. The simplest landscapes often are the most attractive. Remember to create spaces instead of filling them up.

Accent

Accent is important in the total landscape picture and also is referred to as dominance, focalization or climax (fig. 4). Without accent, a design may be dull, static, or uninteresting. When skillfully organized, various parts of the landscape lead the eye toward the focal point. This may be a garden accessory, plant specimen, plant composition, or some use of water. Emphasis also can be obtained by using contrasting textures, colors or forms, or by highlighting portions of a plant composition with garden lights.

Repetition

Do not confuse repetition in the landscape with monotony. A row of sheared hedges lined up in front and down the side of a home is not repetition; it is monotony. Repetition is more subtle. For example, use curves in the landscape design. Curves may begin in bed lines in the front yard, continue in the side yard, and be picked up once more in the backyard. Alternatively, the repeated use of right angles on a grid design can be used to achieve unity in the landscape. Right angles may begin in the front yard, perhaps on the sidewalk and then be used in bed lines, which go around the property and be picked up again in the backyard. To achieve a continuity or flow to the entire landscape, subtly repeat design elements, such as bed lines in the yard (fig. 5).

Harmony



Figure 6. Lack of harmony versus harmony.

Harmony is achieved through a pleasing arrangement of parts (fig. 6).

Space Dividers, Accents and Transitions

An easy way to combine plant and architectural characteristics is to consider space dividers, accents, and transitions. These three elements are present in all successful landscape compositions.

Space dividers define or give privacy to spaces, create the background for outdoor living activities, and create dominance. Space dividers can be fences, walls, hedges, or borders. Space dividers must have height, be arranged in groups that border spaces (open lawn or patio area) and contain the most visually uniform characteristics in the composition (fig.7).

Transitions form the connecting link between space dividers and accents, or between the house and the land. To harmonize these elements, the transitions must be composed of characteristics that are found in both the space dividers and accents.

Accents, which are actually a minor part of the composition, create interest by contrasting characteristics with the space dividers. Accents may be displayed in two ways: hidden in niches within the space dividers, or standing free within the area created by the space dividers. In any design, only one of the two methods should be employed or visual confusion may result.

Dominance and Contrast

In any composition, a majority of dominant or

repeated characteristics are accented by a minority of contrasting characteristics.

For a garden in which little time is spent, the magnitude of contrast between the dominant characteristics and accents is very strong. Gardens of this type include entrance courts, street-side foundation plantings, entrances to public buildings, or plantings seen from the roadway. The magnitude of contrast refers to the degree of change between visual characteristics, such as plant type, height, form, color, and texture.

Generally, the ratio of dominant characteristics to contrasting features should be about 80 to 20 percent or 90 to 10 percent. Also, the accents must be concentrated in one area. Gardens of this type take on a bold, architectural effect as in many contemporary California gardens. The effect can be grasped and understood at a glance.



Figure 7. Space dividers.

For a garden in which a great deal of time is spent, such as a viewing garden, a private garden adjacent to the home or a dining garden, the magnitude of dominance to contrast should be about 70 to 30 percent. The contrast can be placed rhythmically instead of concentrated in one area. This type of garden is appropriate for relaxing and meditating. It often takes on a Japanese effect, which is conducive to contemplative study needed to grasp the garden's essence.

The ratio of dominance to contrast should never drop to 55 to 45 percent; at this point, dominance is lost and visual confusion results.

An example of a plant composition containing a strong contrast between space dividers, transitions, and accents is described as follows: the space divider is formed by grouping hemlock, spruce, and white pine (all narrow leaf evergreen trees); the accent is formed by a massing of crape myrtles (flowering deciduous trees); and the transition is formed by a massing of firethorn (a broadleaf evergreen shrub). Contrast between space dividers and accents in this example is created by tree types, evergreen and deciduous; form, evergreens are pyramidal, in contrast to the rounded crape myrtle; and height, evergreens grow to at least 40 feet in contrast to crape myrtle, which grows to about 15 feet.

Drawing a Landscape Plan

The following section describes how to draw a landscape plan that embodies the elements of good design. For the fun and satisfaction of preparing your own landscape plan, follow these steps:

- Prepare the map
- Decide how the ground area is to be used
- Place use areas on the map
- Develop the landscape plan
- Prepare a planting plan

By following these steps, you will be able to develop a final plan that can be implemented over several years as time and money permit.

Step 1 - Preparing a Baseline Map

Prepare a scale map of the home grounds (fig. 8). Use graph paper and let one square equal so many feet, or draw the map to scale using a ruler or an engineer's scale.

Scale	Small Lot	Large Lot
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Engineer 1 inch =	10 feet	1 inch = 20 feet
Ruler 1 inch =	8 feet	1 inch = 16 feet

The map should include the following: property lines; undesirable features of home grounds or of adjoining property; north point; views (use arrows to show the direction of each good view); house, garage and other buildings; doors, windows, porches, and room locations; existing trees and rock outcroppings; walks and driveways, if already constructed; contour of the land (use an arrow to show the direction of surface water flow); scale used; and location of septic tank or sewer lines.

Step 2 - Deciding the Ground Area

Items listed below are included most often in the final development. Make a list that suits your individual needs.

- Front lawn area or public area
- Outdoor living or private area
- Laundry area
- Children's play area
- Vegetable garden
- Small fruit garden
- Cooking and eating area
- Driveway
- Guest parking
- Turnabouts
- Garden pools
- Flower beds
- Walks
- Garage
- Any other items particular to your land area

Step 3 - Placing Use Areas on the Map

Place use areas on the map (fig. 9). Fit them together with two considerations, traffic flow and use. To decide where things should be, answer the following questions. How will people move from one area to another or from the house to an outside area? Will movement be comfortable? Will the outdoor area be functional in relation to the house? Will it make use of existing features, such as views or changes in the terrain? Try different combinations in relation to rooms of the house, surrounding areas, and potential views.

Step 4 - Develop the Landscape Plan

Design driveways, parking areas, and walks. Indicate where plant masses are needed to separate areas, screen

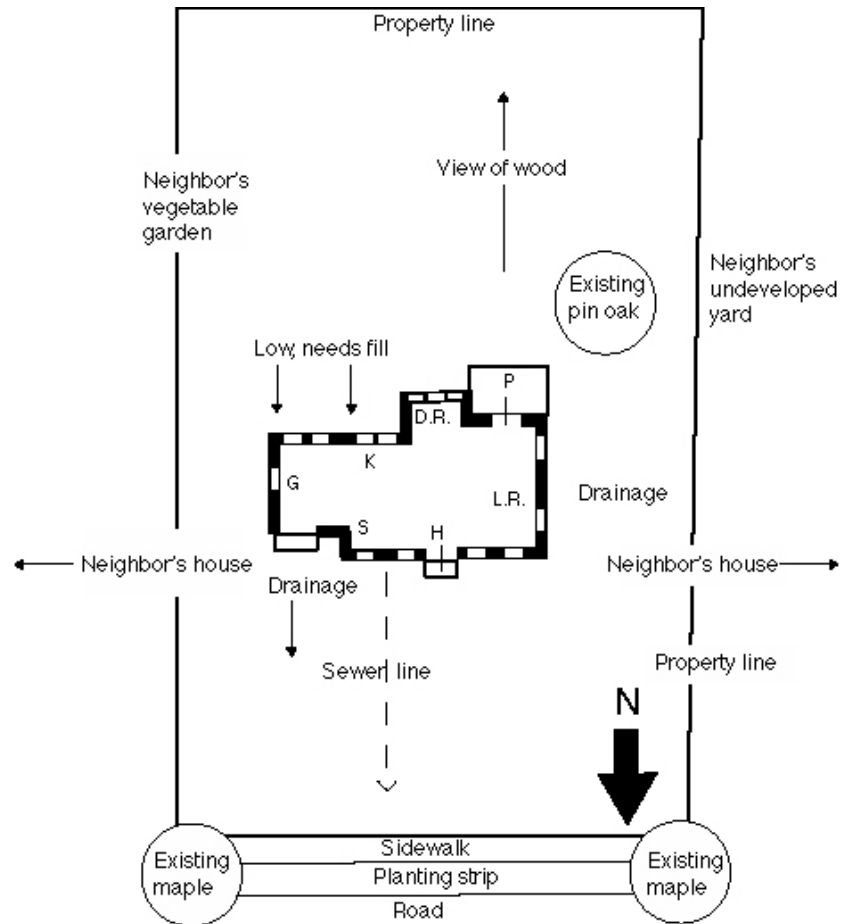


Figure 8. Example of baseline map.

undesirable views, and provide shade, windbreaks, and beauty.

At this point, do not attempt to name trees and shrubs. Instead, think in terms of plant masses that will serve a purpose and help tie the various areas together into a unified plan, while considering the design elements previously discussed.

In preparing the plan, use landscape symbols to indicate trees and shrub masses (fig.10).

Draw symbols to scale to represent the actual amount of space that will be involved. For example, a white pine tree at maturity will have a spread of approximately 20 feet. Thus, make the scale diameter of the symbol 20 feet. Indicate on the map where paving, plants, and structures will be located (fig.11).

When developing the plan, check to see if the proposed scheme is practical and if you can answer the following questions satisfactorily:

- Is the driveway design pleasing, useful, and safe?
- Does the driveway have a safe entrance? Is there a turnabout? Guest parking?
- Will guests use the front door?
- Are service areas convenient and screened from public view?
- Will the proposed drive be too steep?
- Are walkways convenient?
- Will the view be attractive from the indoor living areas?
- Has a living area been provided and is it screened from the neighbors?
- Is the clothesline close to the laundry?
- Do all the parts fit together into a unified plan?
- Have good setting, background and privacy been provided?
- Are the house and major plants set back in case the highway department or local government decides to widen the road or street?
- Will the proposed location of a septic tank and drainage fields interfere with planting needed

shade trees?

Step 5 - General and Specific Planting Plan

First, for each tree or shrub mass on the plan, make a set of specifications. These specifications should include the following:

Height - low, medium, or tall

Form - spreading, upright, arching, or globe

Purpose - shade, background, hedge, screen, accent, or mass

Seasonal interest - fruit, flowers, or foliage

Type - evergreen, broadleaf evergreen, or deciduous

Maintenance - subject to insects or plant diseases

Cultural needs - shade, sunlight, and moisture requirements

Then select a plant or group of plants to meet the specifications. Consult garden books and nursery catalogs or visit a local nursery. Become familiar with plant materials and discuss your plan with nursery staff.

On the map developed in Step 4, designate specific plantings (fig.12).

Selecting of Plant Materials

Well-chosen plantings are necessary to achieve the desired landscape effect. There are hundreds of varieties of trees, shrubs, vines, and perennials from which to choose. Remember, plants are not merely ornamental accessories; they make up masses and define space in the yard and garden. Therefore, when selecting plants, consider both their cultural needs and aesthetic values.

Cultural Considerations in Selecting Plants

Several cultural issues need to be considered when selecting plants.

Hardiness

This is the plant's ability to withstand winter and summer climatic changes. It also refers to plant longevity or permanence. Usually, a fast-growing plant has a

short life span and, consequently, needs replacing after a few years.

Soil and Moisture Conditions

These are important aspects of the plant's environment. Some plants respond unfavorably to changes in soil or moisture. For example, some plants can tolerate extremely dry or wet conditions, while others cannot.

Degree of Sun or Shade

This depends on where the plant is located in the garden. Some plants cannot tolerate the sun, while others

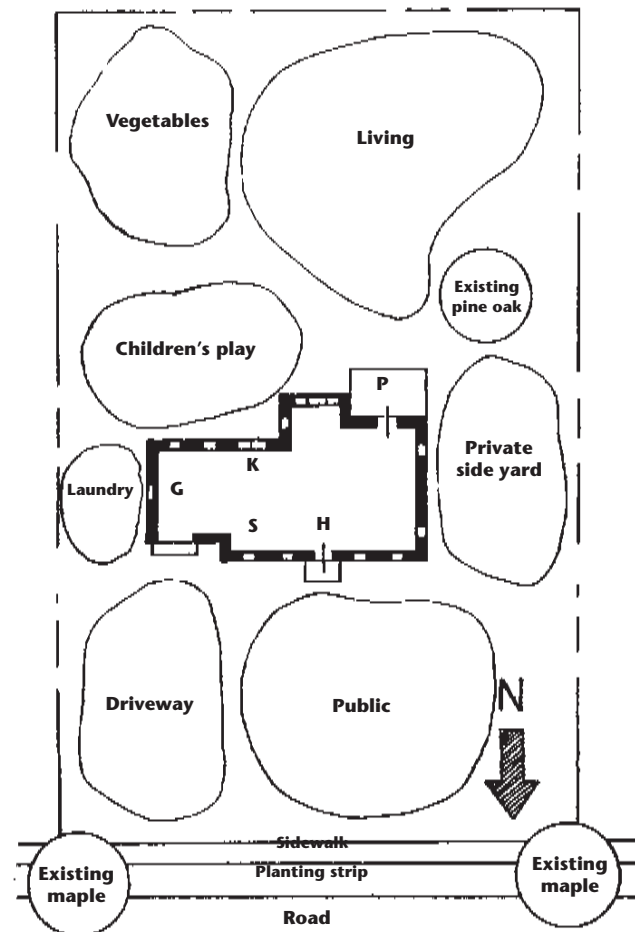


Figure 9. Placement of use areas on the map.

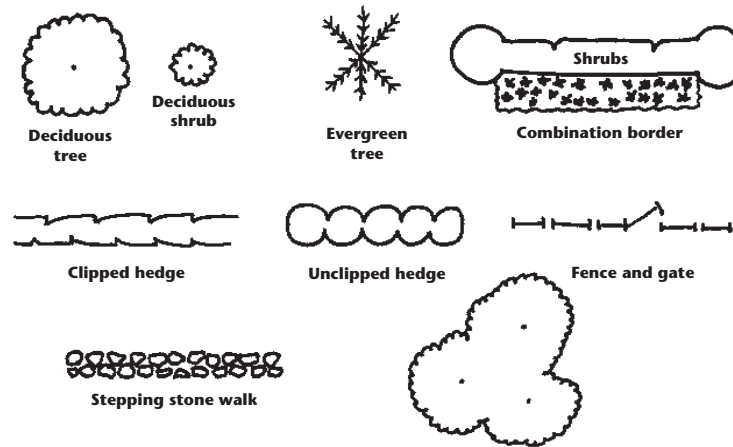


Figure 10. Landscape symbols.

require full sun for best display.

Maintenance

When selecting plant materials, consider the practical aspect of maintenance. Try to choose trees and shrubs that tend to be disease and insect resistant.

Aesthetic Value

This includes texture, color or foliage, flower, fruit, and bark. Select colors related to the house exterior, especially if the plant is used close to the house. Strongly contrasting textures can create interesting effects.

Aesthetic Considerations in Selecting Plants

In addition to cultural considerations, aesthetics are a vital part of selecting plants.

Plant Size

The plant's mature size must be considered when selections are made for the landscape plan. A common mistake is to select plants that become too large for their location. The drastic pruning that becomes necessary adds to the maintenance cost and may reduce the specimen's grace and beauty. Overgrown plants that are left unpruned will alter the design's balance and accent and may partially hide the house that they are supposed to complement.

The landscape picture is constantly changing, because the plants that give it form and substance are continually growing. This presents the landscape architect with a challenge not found in most other artistic

media. Great care must be exercised in selecting plants that will immediately create the desired composition and yet retain an appropriate size over many years.

Plant Form

Trees and shrubs used in landscaping develop many distinct forms (fig.13). The more common forms are prostrate or spreading, round or oval, vase, pyramidal, and columnar. Mature shrubs and trees usually are more open and spreading than young plants. For example, the head of a young oak tree may be pyramidal in shape. During middle age, the head is an irregular oval. During old age, a large, massive oak may have a spreading vase form.

Ground covers, such as turf, low-spreading shrubs, creeping plants, and prostrate vines, are essential materials in landscaping. The principal use of turf is for the lawn area. Other ground cover plants are used commonly on banks that are too rough or steep to mow or under trees where grass will not grow well.

Shrubs are woody plants that reach heights up to 15 feet. They may have one or several stems with foliage extending nearly to the ground. The more common shrub forms are low-spreading (juniper species); round or upright (a large majority of shrubs fall into this general form); vase (*Spiraea X Vanhouttei*); pyramidal (*Arborvitae* spp.); and columnar (*Juniperus* spp.).

Trees are woody plants that typically grow more than 15 feet tall and commonly have one main stem or trunk. The head or leafy portion of the tree develops

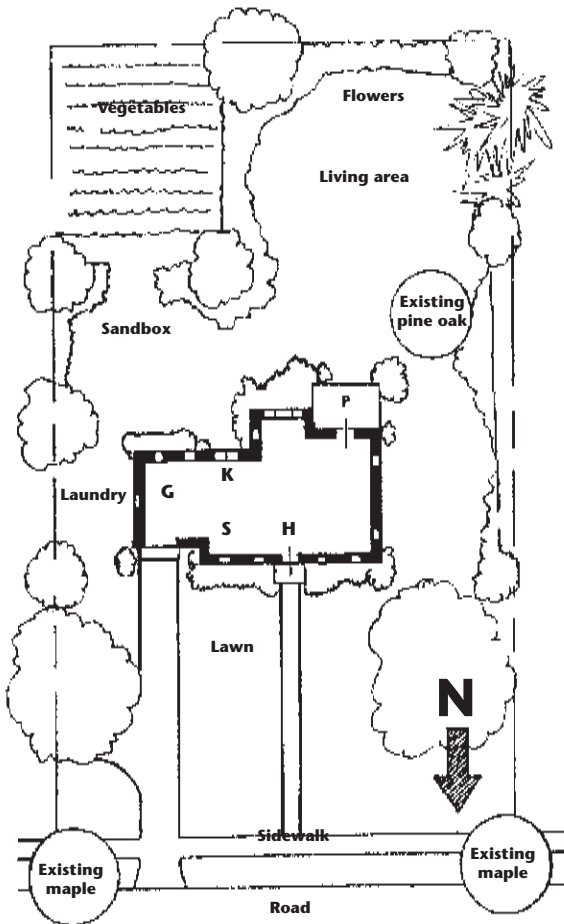


Figure 11. Map of paving, plants, and structures.

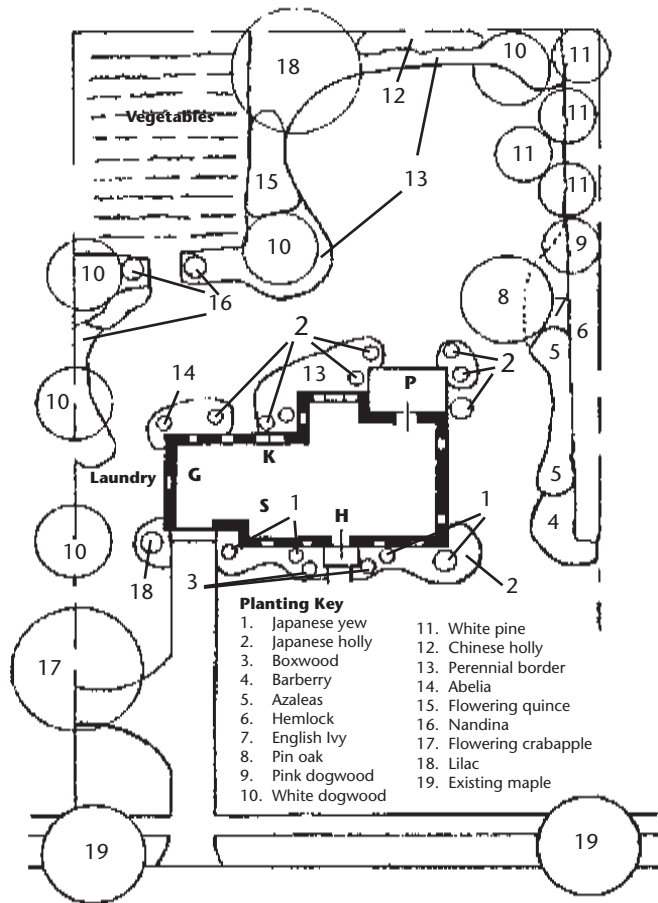


Figure 12. Designation of specific plantings.

a typical form. Examples include round or oval (most common trees like sycamore, oak and pine); vase (elm); pendulous or weeping (willow, cherry); pyramidal (spruce, fir); and columnar (Lombardy poplar, Italian cypress).

Trees are long-lived and relatively inexpensive in initial cost and maintenance compared to lawns, flower beds, and many other design features. In the past, many builders have committed costly errors by destroying trees when establishing new residential subdivisions. Many real estate developers now appreciate the value of trees and try to save them when land is graded prior constructing houses. Regardless of our affection for trees, we must recognize that they do not live forever. Old and improperly located trees should be removed and new, more suitable specimens should be planted.

Plant Texture

The texture of plant materials depends on the foliage's size and disposition. Plants with large leaves that are widely spaced have coarse texture. A plant with small, closely spaced leaves has fine texture. Extremes in texture that prevent harmony in the composition should be avoided. On the other hand, some variation in texture is needed to give variety. Texture can be influenced on a seasonal basis, depending on whether the plant is deciduous or evergreen.

Plant Color

Green is the basic color of most plant materials in the landscape picture. Using plants with lighter or darker foliage tones can add variety. Accent may be introduced by the selecting flowering shrubs or those

that produce colorful, persistent fruit. Care should be exercised in using particularly showy plants, such as hydrangeas or blue spruce. Such plants may dominate the landscape and destroy the composition's balance and unity.

Woody Landscape Plants

Woody ornamental plants are key components in a well-designed, useful landscape. This large group of plants falls into four categories: vines, ground covers, shrubs, and trees. These categories are defined as follows:

Vines — Climbing or crawling woody plants without self-supporting upright stems.

Ground covers — Very low-growing, spreading vines and shrubs.

Shrubs — Woody plants that remain quite low and produce shoots or stems from the base with usually more than a single trunk (height of 15 feet or less).

Trees — Woody plants that produce one main trunk and a more or less distinct and elevated head (height of 15 feet or more).

Vines

Vines generally are described as woody or semiwoody climbing or trailing plants. Like shrubs, trees, and ground covers, vines add interest to any garden landscape. Many vine species or varieties possess distinc-

tive characteristics that make them well-adapted to certain locations in the landscape plan.

Selecting Vines

When selecting vines, trees, and shrubs, carefully review the needs of the area and then select the most suitable plants. Vines can be useful in a variety of sites. Some vines are valued for the shade they provide when trained over an arbor. Others add interest to a planting when trained against a building wall or when used to frame a doorway. Some vines are used to relieve the monotony of a large expanse of wall; they can be trained in a definite pattern or allowed to completely cover a wall with leafy green foliage. Other vines can dramatically change a plain fence. Vines are useful as ground covers, forming a cascade of bloom on rough, steep banks, while holding the soil in place. Most recently, vines have been used as ground covers to replace turf areas in an attempt to reduce irrigation and maintenance needs.

Vines offer diverse visual qualities and are valued for the rich texture of their foliage and their decorative growth habit. They also are desired for their fragrant blooms or their beautiful flowers. Some are valued for the graceful tracery of their simple stems or for the beauty of their leaf pattern. To the landscape professional, vines offer a rich source of material with which to create interesting, exciting, and beautiful plantings.

Depending on how they climb, vines usually are segregated into three general groups. Some vines, like Boston ivy, climb by attaching small, rootlike

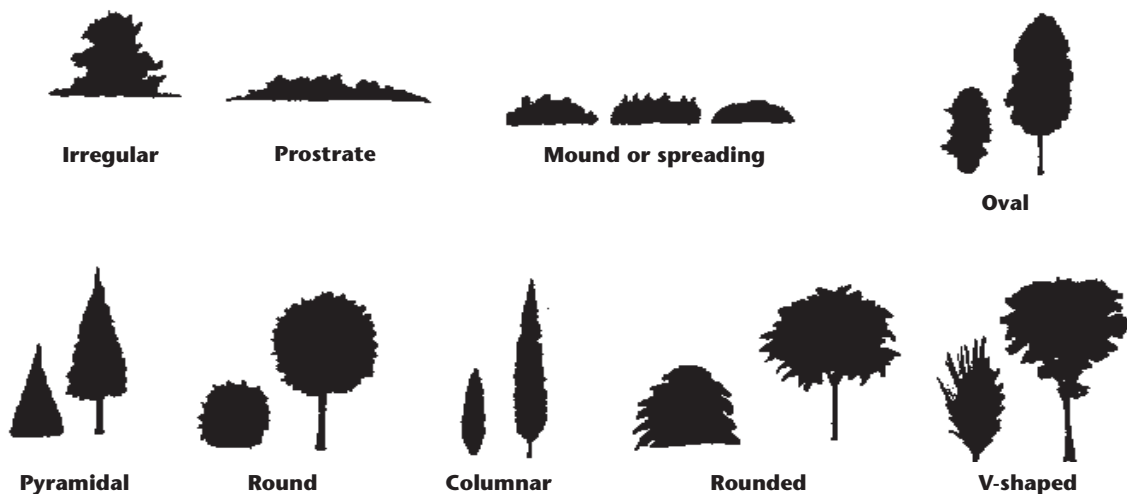


Figure 13. Plant forms.

holdfasts to the wall as a means of support. These may be modified tendrils with small circular discs at the tips. Others vines, like English ivy, have small rootlets along the stem that firmly attach to either brick or wood.

The second group of vines, such as clematis and grape, climb by attaching and winding tendrils, or leaflike appendages that act as tendrils, around the object on which they are growing.

The third group of vines, including bittersweet and wisteria, climb by twining. It is interesting to note that different vines twine in different directions. As an example, bittersweet vines twine by climbing from left to right, while Hall's honeysuckle twines by climbing from right to left.

By knowing in advance how each vine climbs, the proper means of support can be selected. It also should be noted that the climbing action of many vines can be quite damaging to wooden structures, such as fences or arbors. Make sure any such structures are designed to withstand the vigorous growth of most vines.

Culture

Most vines quickly revert to a tangled mass of foliage on the ground, if they are not given the proper means of support and a reasonable amount of care and maintenance. The best type of support for vines gives the required structural strength and stability and, at the same time, has a neat appearance. Beware that holdfasts and rootlets, such as those on English ivy, can damage stucco and wood siding on a house.

Like most other plants, vines require some maintenance. Pruning is necessary to remove old wood and may require several cuts to each stem so they can be untangled. Pruning occasionally is necessary to keep the plant within bounds and to guide future growth. As with other plants, vines also can be pruned to produce better bloom or fruit.

Managing insect and disease pests is required for vines. This involves regular visual inspection for pest damage and, if necessary, use of environmentally sound control measures.

Carefully study the area to determine what type of vine to use. Growth rate is a critical consideration since some vines, such as grapes, wisteria, and trumpetvine, exhibit rampant growth - soon becoming a

nuisance.

Ground Covers

In a broad sense, ground covers include any material that prevents rain from directly striking the ground and covers the ground surface so that it cannot be seen from above. Under this definition, grass, various types of paving, shrubs and even trees could be called ground covers. In this handbook, however, ground covers refer to low, mat-forming or trailing plants (up to 18 inches tall) other than turfgrasses or plants that tolerate walking or mowing. Most ground covers are not intended to be walked upon and may be severely damaged by pedestrian traffic.

When ground covers are carefully chosen and correctly placed, they greatly enhance the beauty of the landscape composition. In addition to their aesthetic value, they fulfill a number of other important functions: control erosion on slopes; control traffic without impeding view; conserve soil moisture and lower soil temperatures during periods of extreme heat; reduce lawn maintenance; fill narrow, odd-shaped areas where mowing and edging may be difficult; provide vegetative growth where grass is difficult to maintain; and produce interesting patterns with variation in height, texture and color.

In practice, the most frequently used ground covers are plants that are easily propagated, vigorous and hardy.

Selection

Ground cover selection depends upon the area where it will be used. When selecting a ground cover, consider the following questions: Is the area flat or sloping? Is it in sun, partially shaded or deeply shaded? Study the soil conditions; some ground covers prefer a moist soil rich in organic matter, while others adapt to dry, sandy situations. Consider color, texture, height, and growth habit, since some ground covers tend to grow rampantly and may become nuisances.

Since large numbers of small, individual plants are required, one problem that may limit the use of ground covers is the cost of installation. A well-prepared planting bed is essential for ground covers to establish, but it can be costly and time-consuming. Weed control in a newly planted ground cover bed can likewise be difficult and labor-intensive.

Culture

Significant maintenance is necessary the first 1 to 3 years or until the ground cover becomes established. This includes cultivation to control weeds and other plant invaders; fertilization to encourage fast, vigorous growth and to achieve good cover; irrigation in times of dryness; and disease and pest management. If these maintenance considerations are ignored, the resulting ground cover planting is disappointing.

Ground covers can be used successfully where paving, lawn, or flower beds are not desired. Newly cut banks and any slopes greater than 12 percent are best treated with ground cover plantings. Around buildings, ground covers are superior to paving or structural controls for reducing heat, glare, noise, and dust.

Trees and Shrubs

Because there are so many woody plants available for use in landscaping, carefully consider plants that are appropriate for your needs.

Selecting Trees and Shrubs

Selection should be based on several different factors.

The intended purpose should influence the selection of plants for appropriate shape, size, and other physical characteristics. Trees are used for shade, ornamentation, screening, and windbreaks. Shrubs are used for screens, barriers, windbreaks, ornamentation, ground covers, and wildlife shelters. Both trees and shrubs can be selected for their edible fruits or nuts.

Providing shade usually requires tall, sturdy, long-living species. Density of foliage determines the amount of shading. A tree that produces very dense shade, such as a mulberry, may prevent other plants from growing beneath it. Other trees, such as a honey locust, produce light or partial shade that does not hinder the growth of other plants below it. Deciduous trees that drop their leaves in winter can be used to shade the southern windows of a home during summer, and thus allow sunlight to penetrate the same windows in winter.

Screens usually require plants that produce dense foliage. Evergreen plants usually are chosen for screening. In addition, plants used for windbreaks must be able to survive rigorous climatic conditions. Barrier plantings usually require sturdy plants with dense growth and, possibly, thorns or spines.

Ornamental attributes are quite varied. Both trees and

shrubs can be used for their colorful flowers or fruit, interesting foliage, fall color, interesting bark, winter foliage or branches for decoration, as well as for the interesting shapes of the plants themselves.

Consider the size of mature trees and shrubs and where they are to be used. Tall trees, such as cedar, elm, and sycamore, are suitable for two-story and taller buildings. They tend to dominate or hide low, flat, one-story buildings. For attractive and proper balance with one-story buildings, select trees that reach maximum heights of about 35 feet. Shrubs that outgrow their spaces can hide windows, block walkways or crowd out other plants. Shrubs can sometimes be kept small by pruning, but this requires continuous maintenance. Careful consideration of mature size reduces the need for pruning.

Shape is especially important in selecting trees for ornamental and shade purposes. Tall trees with long, spreading or weeping branches give abundant shade. Small trees and trees of other shapes are useful for ornamental purposes, but they may not give abundant shade.

Environmental conditions should influence the selection of plants. Size of the planting area is important, as are other site characteristics, such as full sun or shaded, wet or dry, and exposure to winter winds or pollution. Selected plants should be tolerant of existing conditions and should be hardy in the appropriate climate zone. The United States is defined in a series of zones based on average minimum winter temperatures; these zones are illustrated in the U.S. Department of Agriculture Hardiness Zone Map (fig. 14). Remember that a "hardiness zone map" does not reflect information concerning soil type, summer heat, or average rainfall within each zone. It should only be used as a guideline to determine if a plant species can withstand the average minimum winter temperatures of a specific zone. While this map contains the most recently published information, the guidelines may not be accurate enough to guarantee plant survival in extreme cold.

Finally, consider how much maintenance the plant requires and any possible disadvantages associated with the species, including susceptibility to diseases and insect pests; soft or brittle wood that is easily damaged by wind and ice; fruits and seeds that are large, messy, smelly, or otherwise obnoxious; and plants that abundantly shed twigs and small branches. Some examples of these conditions are the slow death of Arizona ash from age and borers, the breaking of Siberian

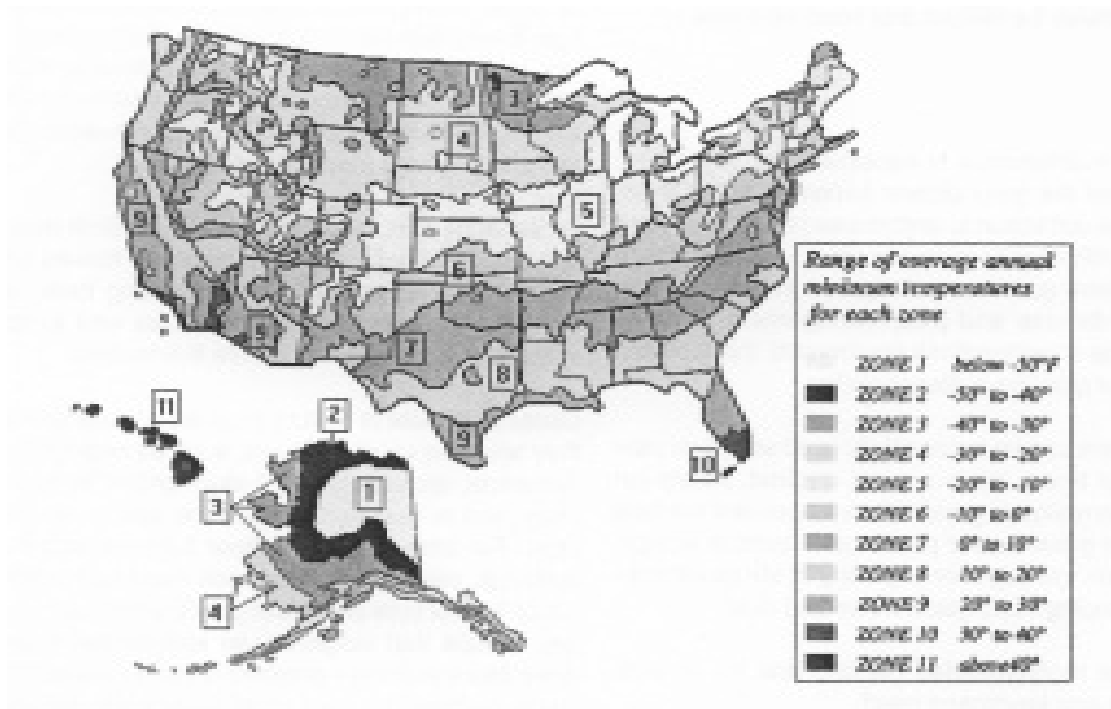


Figure 14. USDA hardiness zone map.

elm branches by wind and ice, and the production of foul-smelling fruit by the female ginkgo. Fruit production by the mulberry, which attracts birds, also can be undesirable. Since the fruit is soft, dark, and decomposes rapidly when ripe, it is messy on walks and attracts flies and other insects. However, male tree varieties may produce pollen causing allergies. Trees with larger, bee pollinated flowers cause fewer pollen allergy problems.

Purchasing Trees and Shrubs

Once all selection criteria have been considered, it is time to purchase plants. Transplants are grouped into the following three classes according to the way they are dug and/or shipped: bare-root plants, balled-and-burlapped plants, and container-grown plants (fig.15).

Bare-Root Plants

These plants have had the soil washed or shaken from their roots after digging. Plants handled this way are nearly always deciduous trees or shrubs in their dormant stage. Most mail order plants are of this class, because plants in soil are too heavy to ship economically.

Plants in the bare-root class are planted while they are dormant. Therefore, late winter planting is best for these plants. Never let the roots dry out. This is perhaps the most common cause of failure with bare-root plants. Keep roots in moist sawdust or wrapped in plastic or wet paper until you are ready to place the plant in the hole.

Balled-and-Burlapped Plants

These plants are primarily trees and some shrubs. They usually are grown in nursery rows for some time and are root-pruned, so that the root system within the balls is compact and fibrous. Such plants rapidly reestablish themselves. This method is used primarily for plants that never lose their foliage and thus are not amenable to bare-root treatment. These plants include broadleaf

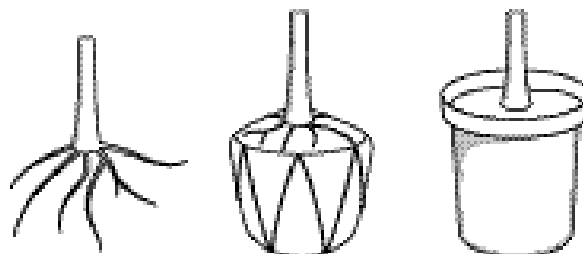


Figure 15. Ways to purchase woody plant species.

evergreens and conifers of all types. A number of deciduous trees and shrubs that have branching root systems are contained easily in a soil ball and also are sold as balled-and-burlapped plants.

Plants in this class are planted almost any time the ground can be worked. Plants put out in summer will need special attention to keep them adequately watered.

When selecting a balled-and-burlapped plant, be sure that the ball is sound and has not been broken. Avoid plants that feel loose in the soil balls. Be sure the soil ball does not dry out. These plants usually will need very little pruning at planting.

Container-Grown Plants

These plants usually are grown in the container in which they are sold and are becoming a standard in the nursery trade. Container-grown plants can be planted throughout the year. Because of their appearance, many home gardeners often are misled into thinking that all they have to do is put these plants into the ground and forget about them. Nothing could be further from the truth.

These plants may have what is called a “container habit.” Their roots are contained in a limited space and may be tightly coiled around one another in the container. Some of the larger roots may have coiled back around the trunk, thus initiating a process known as root strangulation or girdling root.

To solve the problem, split the lower half of the root system and spread the roots horizontally (fig. 16). This practice prunes the roots to encourage new laterals, prevents girdling roots and raises the lower roots closer to the soil surface.

When selecting plants, look for those with a good, natural shape without any thin spots or broken limbs. Make sure the root ball is solid, and the bark has no broken places (fig. 17). Avoid container-grown plants if the roots are circling on the surface or coming out of drainage holes. Choose plants that are free of any insects or diseases. Generally, smaller plants cost less and may establish faster. Do not buy plants so small that they are in danger of being walked on or mowed over.

Planting Trees and Shrubs

Installing plants properly in the landscape involves

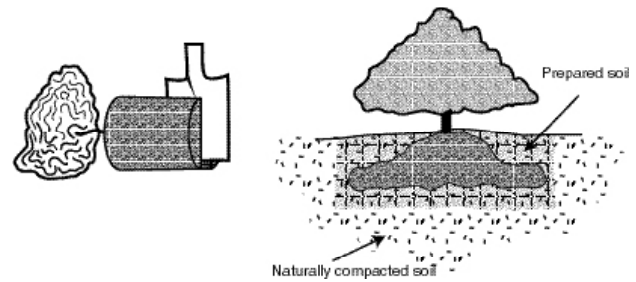


Figure 16. Splitting the rootball of container-grown plants.

much more than just digging holes and setting plants in them. The planter is responsible for developing as satisfactory a microclimate as possible for optimum plant growth and development. A healthy and vigorous plant is required if the landscape is to have the desired effect, and healthy plants need less maintenance in the years following establishment.

The planting hole is important since this is the root system's environment. Generally, the hole should be twice as wide in diameter and no deeper than the soil ball. In general, research shows that the wider the hole, the better the plant will grow.

A traditional recommendation for preparing planting holes for trees and shrubs has been to incorporate organic matter into the backfill soil before returning it to the hole around the plants. However, recent research indicates that this actually can be detrimental to the long-term establishment of the landscape plant. By backfilling the hole with native soil, the plant is immediately forced to establish new roots in the backfill and beyond.

Apparently, the addition of organic matter into backfill soil creates an interface between the amended soil and the undisturbed soil around the planting hole that is detrimental to root growth and water movement between the two soils. In tests conducted at the University of Georgia, scientists found that the majority of the roots in holes with amended soil were confined to the original planting hole. Therefore, only excavated soil should be used as backfill.

Place the top of the soil ball at a slightly higher level than the surrounding soil. The finished planting depth (after the soil settles) should be such that the plant is exactly the same depth after replanting as it was when grown in the nursery (fig. 18). When planting in a poorly drained site, set the plant so that a few inches of the rootball are above the soil level to enhance drainage (fig. 19). More plants probably are

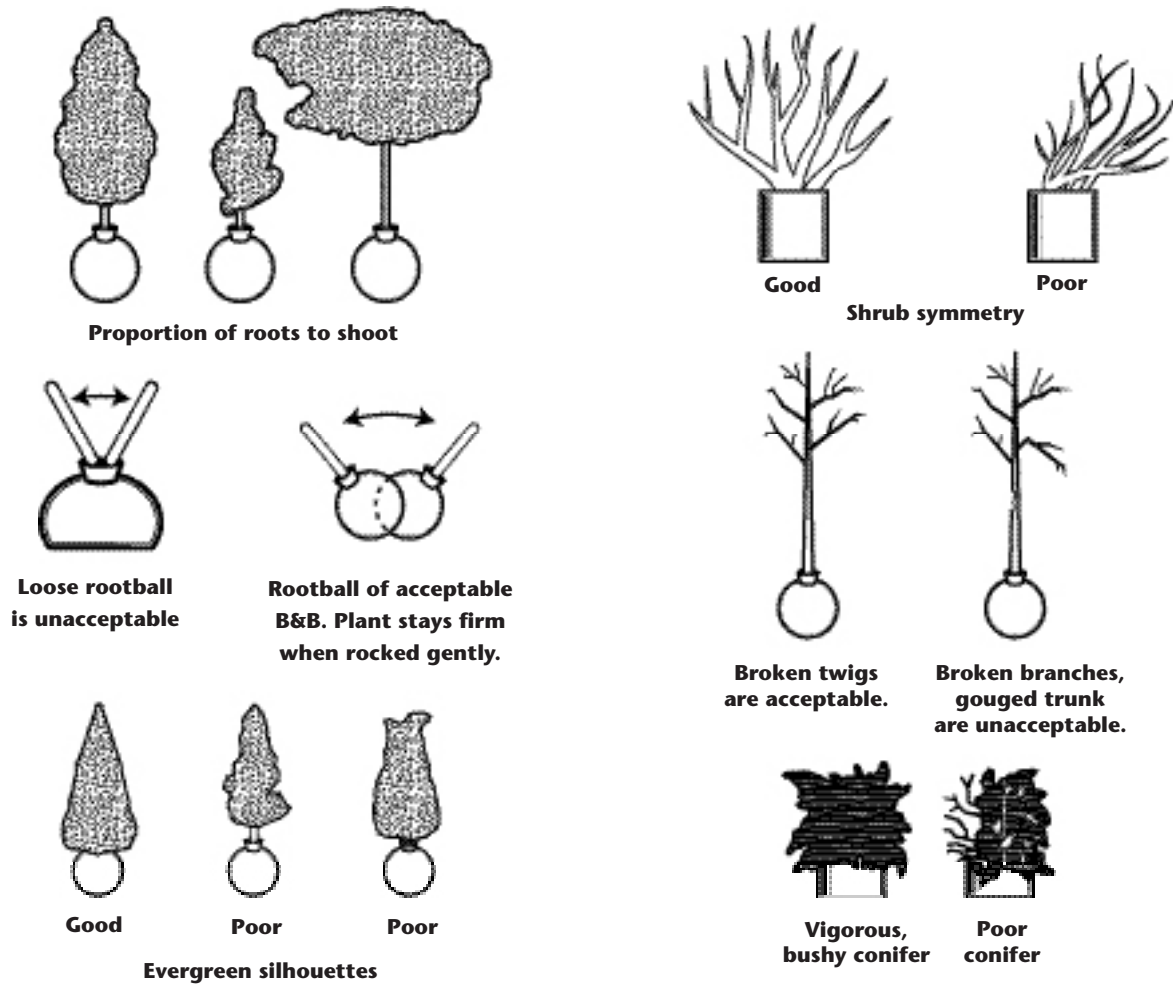


Figure 17. Buying quality plants.

lost because they were planted too deeply than for any other reason.

Carefully handle balled-and burlapped plants when they are placed in the hole. With most species, if the soil ball is broken for any reason, many of the roots will be severed from the trunk and the plant will die. Always pick the plant up by the soil ball or container, but never by the trunk or stem. Recently, some nurseries have been using woven plastic or synthetic materials to wrap these plants. These materials do not rapidly decompose and can girdle roots as they enlarge after passing through the material. It is necessary to remove burlap, plastic, and synthetic materials from the soil ball after the plant is placed in the hole and before backfill is placed around the rootball. For all of these plants, cut and remove any strings (plastic or natural fiber) from around the trunk after planting to prevent girdling the plant.

For container-grown plants, always remove plastic or metal containers before planting. Small containers with tapered sides can be removed by turning the plant upside down and giving the top edge of the container a sharp rap. Catch the soil ball in the hands as it slips from the container. Do not let the soil ball break apart. Larger containers (5 gallons or more) should be cut away with special cutters. If plants have become overgrown in the container and the root mass is growing in a tight, compact circle around the soil ball, cut the outer roots out with a sharp knife in two or four places around the soil ball. Make the cut from the top to the bottom of the soil ball. Decomposable containers, such as papier mâché, do not need to be removed from the soil ball.

Bare-root plants should have the packing material and all damaged or dead roots removed. Do not allow roots to be exposed to sunlight or to dry out



Figure 18. Proper planting depth.

before planting. It is best to keep bare roots covered with moist burlap or some reasonable substitute until planting time.

After the balled-and-burlapped or container-grown plant has been placed in the hole, fill the space around the plant with backfill until it is two-thirds full. With bare-root plants, the soil should be worked gently in and around the roots while the plant is being supported. The most satisfactory way to firm the soil and remove air pockets is by filling the hole with water. If it is not practical to use water, firm the soil by hand around the plant ball or roots. However, be sure not to use excessive force since soil compaction should be avoided.

Before finishing the filling process, make certain the plant is straight and at the proper depth. Then complete the filling process with backfill. If it is an individual specimen, construct a ring of backfill 2 to 3 inches high at the outer edge of the hole's diameter to form a water basin (fig. 20). Bedded plants probably will not require a water basin. Thoroughly water the plant as soon as the water basin is complete. After the water has soaked away, fill the basin with mulch. Organic mulches, such as pine needles, bark and wood chips, provide the best environment for future root development.

Note that fertilizer is not added to the backfill mixture. Newly developing roots can be damaged by too much fertilizer. If soil testing indicates that fertilizer is needed, add a water-soluble material at the recommended rate during the final watering phase. Large areas should have an established fertility level based on soil test results before individual plant specimens are planted. A fertility program should begin in late fall of the first growing season.

One final activity in planting any plant is to remove

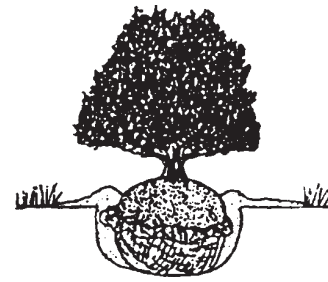


Figure 19. Planting in a poorly drained site.

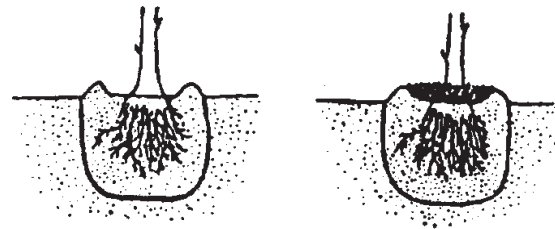


Figure 20. Soil depression around a planting hole.

all tags and strings. These items, whether made of wire, plastic or natural fibers, can girdle fast-growing stems and trunks.

Pruning and Supporting Newly Installed Plants

An initial pruning may be needed immediately after planting. However, only remove broken and damaged branches (fig. 21). The traditional practice of removing part of the top growth to reduce transpiration and to bring the top back in proportion to the root system (for example, bare-root trees) is no longer recommended. With newly planted woody species, it usually is more successful to avoid heavy pruning at planting if the plants can be well-watered during their first 1 or 2 years. Pruning reduces leaf area and limits transpiration, but it also reduces the leaf surface area, which produces photosynthates for root growth. Since the plant will not resume a normal growth rate until the original root system size is reestablished, it is better to avoid wilting by watering than by canopy pruning. This also avoids a proliferation of suckers in the inner canopy.

Most shrubs do not need to be supported after planting unless the bare-root stock is quite large or if very tall balled-and-burlapped specimens are

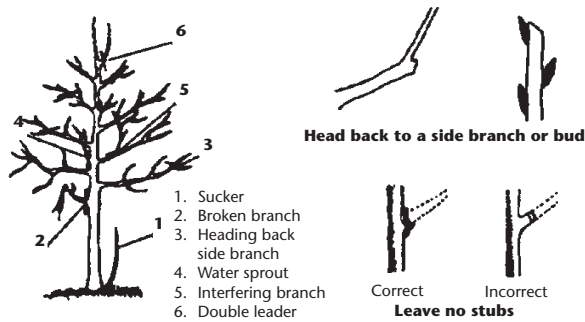


Figure 21. Pruning at planting time.

used. If support is needed, use the same techniques for shrubs that are described in the following paragraphs for trees.

A general rule of thumb is to provide support for all bare-root trees over 8 feet in height. Also, trees that are quite large, 6 inches or more in diameter, should be supported. Smaller balled-and-burlapped or container-grown trees do not usually need support. There are several methods for supporting smaller trees (fig. 22). A single stake about three-quarters the height of the bare-root tree should be driven 2 to 4 inches from the planting hole's center so that the stake will be on the tree trunk's southwest side. This should be done before the tree is placed in the hole. Then plant the tree according to the procedures described in previous paragraphs.

After planting is completed, fasten the tree to the stake with a wire or a suitable substitute formed in a loose loop. Before fixing both ends of the wire to the stake, slip a short length of rubber hose onto the wire. The part of the wire in contact with the trunk should be covered with the rubber hose to prevent injury to the bark as the tree moves in the wind. Two-inch-wide woven strapping can replace the rubber-coated wire where it contacts the tree. This reduces tree trunk damage. With this method of support, the stake is close to the trunk and does not cause maintenance problems. In turf areas, stakes and guy wires outside the perimeter of the planting hole can be troublesome since they hinder mowing operations. Under no circumstances should this method of support be used on balled-and-burlapped or container-grown stock, because it isn't usually possible to locate stakes close to the trunks before planting. If driven through the soil ball, the stakes can damage the soil ball and the roots.

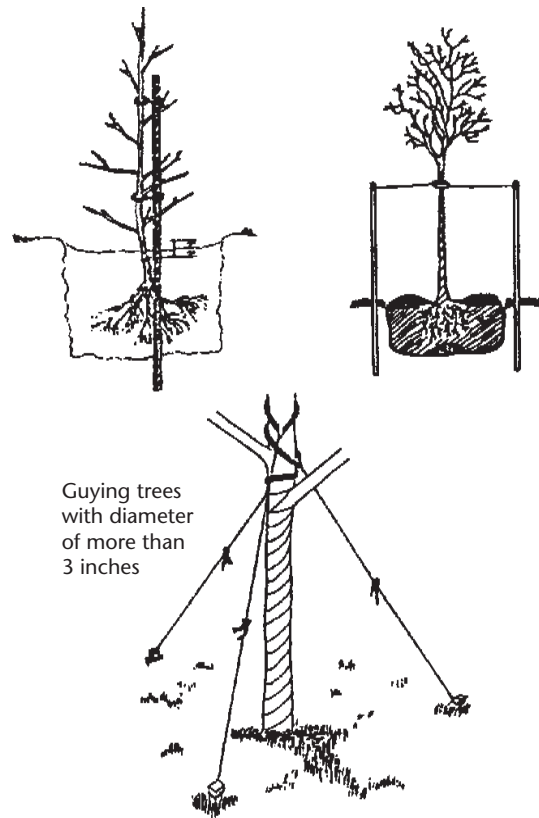


Figure 22. Guying newly planted trees.

A way to support small bare root trees is to use two parallel stakes driven at least 18 inches into firm soil on opposite sides of the tree about a foot beyond the planting hole. The stakes' height after being driven into the ground should be approximately two-thirds the tree's height. The tree is then supported by wires attached to both stakes and looped loosely around the trunk. A length of rubber hose or strapping can be used to protect the tree trunk.

A third and most commonly used method, is to fasten three guy wires to stakes that have been firmly fixed in soil around the planting hole's edge. The stakes should be equidistant from the hole and from each other. Stakes generally are used on smaller plants. They should be driven 18 to 24 inches into the ground at a 45 degree angle away from the tree trunk. It is absolutely essential that all three stakes be firmly fixed so that they will not pull out in high winds. The tops of the stakes are notched to hold the wire. The wire is then fastened two-thirds of the way up the trunk by a loose loop covered with rubber hose, or strapping may be used in contact with the tree trunk. The other

ends of all wires should be fastened equally tightly to the stakes without putting a strain on the trunk. The wires should be firm but loose enough to allow slight movement of the tree, a factor essential to its proper development.

All support should be removed from the small trees within 1 year after planting. The tree should have become established during this time. It has been reported that growth and trunk strength actually are reduced if the supports are left in place for longer periods.

Landscape plants require periodic maintenance to produce the best results. This includes fertilization, winterizing, mulching, watering, and pruning.

Fertilizing Trees and Shrubs

Ornamental trees and shrubs planted in fertile, well-drained soil or in a regularly fertilized lawn should not require annual fertilization. Trees and shrubs that are growing well don't require extra nutrients. If trees and shrubs are growing poorly, fertilization may be helpful.

Plants that are growing poorly may exhibit any or all of the following symptoms: light green or yellow leaves, leaves with dead spots, leaves smaller than normal, fewer leaves and/or flowers than normal, short annual twig growth, branches dying back at the tips, and wilting of foliage.

Poor growth may be caused by inadequate soil aeration, moisture or nutrients; adverse climatic conditions; improper soil pH; and disease or other conditions. Attempts should be made to determine the specific cause in each particular situation so that appropriate corrective measures can be taken. Do not assume that applying fertilizer will remedy quickly any problem encountered. Soil and leaf tissue analyses are necessary to prescribe correct solutions.

The cause of poor growth may or may not be evident. Transplanted ornamentals or those with roots that have been disturbed by construction within the past 5 or 10 years may be in shock. Traditionally, pruning has been recommended to bring the top growth into balance with the reduced root system. However, recent research indicates that such pruning may be detrimental. Efforts should be concentrated on maintaining the existing foliage, which produces the necessary photosynthates to regenerate injured roots. Irrigation, aeration, and fertilization all are recom-

mended to keep leaves on the tree.

Most trees and shrubs tolerate a rather wide range of soil acidity. They usually will grow satisfactorily without special treatment to raise or lower soil pH. However, some plants are exceptions to the rule, such as azalea, blueberry, camellia, laurel, and rhododendron. These plants grow best on acid soil with a pH of 5.0 to 5.5. These acid-loving plants may become quite yellow and grow poorly on soils with a pH of 6.0 or higher. Lowering the pH to these levels is very difficult and requires constant monitoring, therefore these plants are not recommended for New Mexico.

Fertilizer for small trees and shrubs should be based on soil analysis. Spread fertilizer evenly under branches in late winter or early spring. As with turfgrasses, fall fertilization is beneficial for plants that grow poorly, but it should be applied after trees are fully dormant.

Large trees that need fertilization require large doses of nitrogen. Research indicates that complete fertilizers usually are not essential and that the growth response is primarily associated with nitrogen fertilization. On large trees, fertilizer applications should be concentrated at the dripline of the tree, which is the area directly below the outermost tips of the branches, or beyond. The tree's feeding root system is in this large perimeter and, consequently, is where fertilizer and water should be applied. Placing fertilizer in small holes in the soil has been tested, and research now indicates that surface fertilizer is sufficient.

Fertilization might be needed each year for large trees. However, a feeding program must be combined with proper cultural practices. For example, neglecting necessary insect or disease control and failing to remove deadwood from a large shade tree will negate fertilization's positive effects. Fertilizer is not a substitute for water during drought.

A moderate growth rate and good green color are all that is desired of woody plants. Excessive vigor, evidenced by lush green leaves and long shoot growth, is undesirable. Such plants require more maintenance, are more susceptible to winter cold injury and are more likely to break during wind or sleet storms. These plants usually have a shorter life than woody plants with moderate growth rates.

Mulching Plants

For year-round benefits, apply a 2-inch mulch of

compost, shredded bark, or wood chips around shrubs, roses, and recently planted trees. This mulch will conserve moisture, help suppress weeds and grass and moderate soil temperatures. A 2-inch layer should be used under the branches of shrubs and roses of all ages.

A circular area of mulch should be maintained for at least 3 or 4 years around newly planted ornamental trees. It should extend at least 3 feet from the trunk and be renewed as often as necessary to maintain a layer 2 inches thick. A circle of mulch will make it easier to mow around young trees without damaging the bark.

Both organic and inorganic mulches can be useful in the landscape. Some of the more readily available and more commonly used mulches include sawdust, compost, pine needles, rock, gravel, and woven plastics.

Watering the Landscape

Of the tremendous amounts of water applied to lawns and landscape, much of it is never absorbed by the plants and put to use. Some water is lost to runoff if it is applied too rapidly, and some water evaporates from exposed, unmulched soil. But the greatest waste of water is applying too much too often. By simply using effective and efficient watering methods, irrigation requirements can be cut by 10 to 30 percent, plus landscape beauty and quality can be increased dramatically.

Correct watering is vital for developing and maintaining a landscape planting. Lack of water can cause a plant to wilt and ultimately dry up and die. Excessive water can cause root rot; the plant wilts because it is oxygen-starved and, consequently, is unable to absorb moisture. As a rule, plants are capable of withstanding moderate drought more easily than too much moisture. For this reason, it is important to water thoroughly, yet allow the soil to become fairly dry between waterings.

Wilting occurs when roots are unable to supply sufficient moisture to the stems and leaves. Wilting for short periods may not harm plants. However, over a prolonged period, it will cause permanent damage. Sometimes a plant will wilt on a hot day, because moisture is evaporating from the leaves faster than the roots can supply it. If there is ample soil moisture, the plant will absorb water in the evening to firm up the stems and leaves. However, when the leaves remain wilted the following morning, watering is recom-

mended.

It is difficult to make broad recommendations about when to irrigate due to tremendous variations in climatic conditions. However, during summer, newly planted trees and shrubs should be deeply watered once a week. By allowing the soil surface to dry out somewhat between waterings, major root development is encouraged at greater depths where soil moisture is highest. Plants watered frequently but lightly are more apt to proliferate roots close to the surface, making them more vulnerable to wilting. This happens with automatic overhead sprinkler systems that are designed only to moisten the surface and run for a short period of time.

Remember that environmental conditions are the primary factor affecting plant water needs. During cool seasons, less watering is necessary because evaporation from the leaves and soil is slow. Plant water use under clear blue skies can be twice as high as under cloudy conditions.

The best time to water is in the early morning when air temperatures are lower than they are at midday. In the evening, wet foliage can encourage fungus or mildew, making plants unsightly and jeopardizing their health. Be prepared to control diseases if you irrigate at night.

Trees and Shrubs

All trees and shrubs need more frequent watering from planting time until they become well-rooted, which may take two growing seasons. Once established, water-efficient plants can be weaned to tolerate less frequent watering. Proper weaning develops deep roots and makes the plants more drought enduring.

Water established trees, shrubs, and ground covers infrequently, yet thoroughly. In the absence of rain, most trees and shrubs benefit from a twice-a-month thorough watering during the growing season.

A tree or shrub's feeding root system is located within the top 12 to 18 inches of the soil and at the plant's drip line. The drip line is the area directly below the outermost reaches of the branches. Apply water and fertilizer just inside and a little beyond the drip line, not at the trunk. An effective way to water trees and large shrubs is to simply lay a slowly running hose on the ground at the drip line. Move the hose around the drip line as each area becomes saturated to a depth of 12 to 24 inches.

Learn the cultural requirements of the plants in the landscape. Different plants have different water needs; good reference books should provide information on various water requirements. For example, roses require more moisture than cacti. It is particularly important to irrigate plants during winter. Plants continue to lose water during winter, especially when the temperature is above 40°F. This is especially true for evergreen plants. If the soil is dry, the plants may become desiccated, turn brown and die. Therefore, water shrubs and trees several times during winter if soil moisture is low.

Irrigation Systems

The goal of any irrigation system is to supplement natural rainfall in order to give plants a sufficient amount of water without waste. By zoning an irrigation system, grass areas can be watered separately and more frequently than ground covers, shrubs, and trees. Both sprinkler and drip irrigation can be incorporated to achieve water conservation in the landscape.

Sprinkler Irrigation

Sprinkler irrigation is the most commonly used method of landscape watering. The two most common types of sprinkler irrigation systems are the hose-end sprinkler and the permanent underground system. Even though a permanent sprinkler system is more water-efficient than a hose-end sprinkler, both systems require little maintenance and apply large volumes in a short time.

If you have a permanent sprinkler system, make sure the sprinkler heads are adjusted properly to avoid watering sidewalks and driveways. Also, a properly adjusted sprinkler head sprays large droplets of water instead of a fog of fine mist that is more susceptible to evaporation and wind drift.

With either hose-end sprinklers or permanent systems, water in the cool early morning in the summer to avoid excessive waste through evaporation.

Drip Irrigation

In the future, drip irrigation may become the most common and efficient way to water a landscape. Presently, drip irrigation is not as widely used as sprinkler irrigation. New, more user-friendly equipment, has been developed in recent years. In fact, watering lawns

with subsurface drip irrigation is more widely accepted and used in home and commercial landscapes and sports turf.

Drip irrigation slowly applies water to soil. The water flows under low pressure through emitters, bubblers, or microspray heads placed at each plant. Or, the emitters are fastened inside a hose (called tubing) by the manufacturer. The goal is to water the entire root zone of a plant or bed of plants, instead of watering individual plants. These products are called tape-type drip or in-line drip tubing. Regardless of the type of drip products used, water applied by drip irrigation has little chance of waste through evaporation or runoff.

Seeking professional irrigation advice and experimenting with available drip irrigation products in small sections of the landscape are the best ways to become familiar with the many benefits of this watering technique.

Mowers and Flexible-Line Trimmers

Injury and infection started by wounds from lawn mowers and flexible-line trimmers often can be the most serious threat to tree health on golf courses, parks, and landscapes. Most arborists and tree pathologists have been aware of this problem for some time. Extensive research has been conducted on the importance of caring for tree wounds. This research has led to significant adjustments in pruning, cabling, bracing, injection and cavity treatment. Lawn mowers cause the most severe injury during periods when tree bark is “slipping” in early spring during leaf emergence and in early fall during leaf drop. If the bark slips, a large wound is produced even if the injury was minor.

Most tree injuries occur when a power mower is used to trim close to tree trunks. This can be avoided by removing turf around trees or by hand trimming. Care also must be used to avoid harming trees with flexible-line trimmers. They can do a great deal of damage to the bark, particularly on young trees.

Injury usually occurs at the root buttress since it flares out from the trunk and gets in the mower's path. However, injury also is common anywhere from the roots to 1 foot above the ground. Although large wounds are most serious, repeated small wounds also can add up to create problems.

The wound itself is serious, but the wounded tree also must protect itself from invading pathogens. These microorganisms often attack the injured bark and invade adjacent healthy tissue, greatly enlarging the affected area. Trees can be completely girdled from microbial attack following lawn mower wounds.

Decay fungi also become active on the wound surface and often result in structural deterioration of the woody tissues beneath the wound. Many wounded trees that are not girdled may eventually break off at the stem or root collar because of internal decay.

Herbaceous Landscape Plants

Beautiful flowers are the horticulturist's reward for hard work. Flower beds and flower borders provide color against the predominant green of a landscape. They supply accent and contrast, making a landscape lively and interesting. Flowers also complement most of the features established by conventional landscaping materials, such as trees and shrubs. They can add depth, dimension, form and texture. In addition to their most obvious asset—color—flowers can change heights and slopes in the landscape. Flowers also provide culinary herbs for the table and cut flowers for arrangements.

Annuals

Annual flowers live only one growing season. During this time, they grow, flower, and produce seed, completing their life cycle. Annuals must be set out or seeded every year. They have many positive features, they are versatile, sturdy, and relatively cheap. Plant breeders have produced many new, improved varieties. Annuals are easy to grow, produce instant color, and bloom for most of the growing season.

Some annual varieties will self-sow or naturally reseed themselves. In most cases, such reseeding is not wanted since the parents of this seed are unknown and hybrid characteristics are lost. Also, plants will scatter everywhere instead of growing in a designated area. Examples are marigolds, alyssums, and periwinkles. Some perennials—plants that live from year to year—are classed with annuals because they are not winter- or summer-hardy and must be set out every year. Begonias and snapdragons are examples.

There are a few disadvantages to annuals. They must be set out as plants or sown from seed every year. This involves effort and expense. Weekly removal of old

flower heads often is necessary to ensure continuous bloom. If they are not removed, plants may produce seed, complete their life cycle, and die. Many annuals begin to look unattractive by late summer and must be replaced or cut back for regrowth.

Annuals offer a chance to experiment with color, height, texture, and form. If a mistake is made, it only lasts one growing season. Annuals are useful for filling in spaces until permanent plants are installed; to extending perennial beds and filling in holes where an earlier perennial has gone or the next one has yet to bloom; covering areas where spring bulbs have bloomed and died back; and filling planters, window boxes, and hanging baskets.

Culture and Maintenance

Growing and maintaining annual flowers successfully requires similar propagation skill, attention to soil preparation, and adherence to cultural practices as vegetable gardening.

Site Selection

Consider all aspects of the site that affect plant growth, such as light, soil characteristics, and topography. Different annuals perform well in full sun, light shade, or heavy shade. Soil texture, drainage, fertility, and pH influence plant performance.

Site Preparation

Proper soil preparation enhances success in growing annuals. First, have the soil tested and adjust the pH if needed. Check and adjust drainage. To do this, dig a hole about 10 inches deep and fill with water. On the next day, refill the hole with water and see how long the water remains (it should not exceed 8 hours). If drainage is poor, plan to plant in raised beds.

The next step is to dig the bed. Add 4 to 6 inches of organic matter to heavy clay to improve soil texture. Sandy soils have poor water-holding capacity and decreased fertility due to leaching. Add compost to improve the water-holding capability of sandy soils. Dig to a depth of 12 to 18 inches. Finally, add fertilizer just before planting, spade again and rake the surface smooth. Slow-release fertilizers are especially beneficial when used on annuals.

Seed Selection

Although most annuals are now planted as trans-

plants, some annuals are still planted from seed (for example, periwinkles and zinnias). To get a good start toward raising vigorous plants, buy good, viable seed packaged for the current year. Keep seed dry and cool until planted. Plants grown from hybrid seed are more uniform in size and more vigorous than plants grown from seed of open-pollinated varieties. They usually produce more flowers with better substance.

Sowing Seed Outdoors

Do not rush to start seed outdoors or to set out started plants. As a general rule, delay sowing warm-weather annual seed outdoors or setting out transplants until after the last frost date. Most warm-weather seed does not germinate well in soil below 60°F. If the soil is too cold, seed remains dormant until the soil warms and may rot instead of germinating. Some cold-tolerant annuals like larkspurs or poppies should be sown in fall.

Annuals seeded in the landscape frequently fail to properly germinate, because the soil surface crusts and prevents entry of water. To avoid this, sow seed in vermiculite-filled furrows. Make furrows in the soil about 1/2 inch deep. If the soil is dry, water the furrow, then fill it with fine vermiculite and sprinkle with water. Make another shallow furrow in the vermiculite and sow the seed in this furrow. Sow at the rate recommended on the package. Cover the seed with a layer of vermiculite and thoroughly water the seeded area with a fine mist. To prevent excess evaporation of water, keep the seedbed well-watered or cover with a mulch, such as pine bark.

Setting Out Transplants

By using plants previously started from seed, a display of flowers can be achieved in the landscape several weeks earlier than if seeds were sown. Many cool-season annuals may be planted successfully in the southern half of New Mexico throughout winter. Pansies, violas, snapdragons and petunias are good examples. Warm- and hot-season annuals (for example, periwinkles, marigolds, purslane) are best established by planting transplants in late April through May. This is especially useful for annuals, such as verbenas and scarlet sage, which germinate slowly or need several months to bloom.

Buy only healthy plants free of pests and diseases. Before setting out transplants, harden them off by exposing them to outside conditions during the day. This should have been done by the producer. If not,

hardening them yourself helps ensure success. After the last frost date, set out warm-season annuals. For each plant, dig a hole large enough to comfortably accept the plant's root system. Carefully lift each plant from its pot, supporting the transplant by the root ball to prevent root damage. If the transplant is root bound, loosen the roots. Set the transplant in the planting hole and backfill so that the plant sits at the same level it was grown in the container. Immediately irrigate each plant to prevent drought stress. Apply fertilizer as needed to supply plenty of energy for annuals to bloom continuously. Before planting, add a slow-release fertilizer to the planting hole to increase plant vigor.

When setting out transplants in peat pots, set the entire pot in the planting hole. Carefully remove the peat pot. If the lip of a peat pot is exposed above the soil level, it may act as a wick and pull water away from the plant. Also, remove the bottom of a peat pot to ensure proper rooting.

Watering

Do not rely on summer rainfall to keep flower beds watered. Plan to irrigate them from the beginning. When watering, thoroughly moisten the entire bed but do not saturate. After watering, allow the soil to become moderately dry before watering again. A soaker hose is excellent for watering flower beds. It allows water to directly seep into the soil without waste and without splashing leaves and flowers. The slow-moving water does not disturb the soil or reduce its capacity to absorb water. Water wands and drip systems also can be used with great success. The only concern with a hose-end water wand is having enough patience to apply adequate volumes of water. Sprinklers are not as effective as other irrigation techniques since water from sprinklers wets the flowers and foliage, making them susceptible to diseases. Soil structure also may be destroyed by the impact of water drops falling on the surface; the soil may puddle or crust, preventing free entry of water and air.

Mulching

Mulches help prevent the soil surface from crusting and the soil moisture from evaporating. They also prevent weed growth. Organic mulches add humus to the soil. Bark (especially pine and cypress) makes a good mulch for annuals. Woven or permeable plastics also act as effective mulches. However, it may be more aesthetically pleasing to cover plastic with another mulch.

Weed Management

Mulch probably is the most effective, efficient and economical control of noxious weeds in a flower bed. Recent research shows that nugget bark mulch allows more effective weed control than shredded bark, and it is just as effective as plastic mulch.

A few herbicides, both preemergent and postemergent types, are labeled for particular flower species. Check the herbicide label to confirm safe and proper chemical use on both the flower species and the weed to be controlled. The flower and weed species must be listed on the label, and the proper application rate and technique must be followed in order for the applicator to legally apply the herbicide.

Mechanical cultivation to control weeds is not a desirable management technique. After plants are set out, cultivate only to break crusts on the soil surface. However, when the plants begin to grow, stop cultivating and control weeds by hand or by some other technique. As annual plants grow, feeder roots spread between the plants; cultivation is likely to injure these roots. In addition, cultivation stirs the soil and uncovers weed seeds that may then germinate.

Deadheading (Removing Old Flowers)

To maintain vigorous plant growth and to assure neatness, remove spent, dried-up flowers and seed pods. This is particularly desirable if you are growing ageratums, calendulas, cosmos, verbenas, pansies, marigolds, daisies or zinnias. By removing spent flowers, the plant continues to produce blooms versus directing its energies into producing seed. Some new varieties do not require deadheading, because they are “self-cleaning.”

Staking

Tall-growing annuals like the tall varieties of snapdragon, marigold or cosmos need support to protect them from strong winds and rain. Plants are supported by stakes large enough to hold the plants upright but not so large as to be conspicuous. Stakes should be about 6 inches shorter than the mature plant so that their presence does not interfere with the bloom's beauty. Begin staking when plants are about one-third their mature size. Place stakes close to the plant

but take care not to damage the root system. Secure plant stems to the stakes in several places with paper-covered wire or other materials that will not cut into the stem. Plants with delicate stems like cosmos can be supported by a framework of stakes and strings in crisscrossing patterns.

Fertilizing

When preparing beds for annuals, add fertilizer according to soil test results or from observing plants that have grown on the site. Add fertilizer at planting time, so it does not leach out before plants can benefit. Soil tests may show that sulfur is needed. Ideally, sulfur should be added in the fall so that there is adequate time for the soil pH to change. Once annuals have germinated and begun to grow, additional fertilizer usually is needed. This is especially true if organic mulches are added, since microorganisms decomposing the mulch will use any available nitrogen. When organic mulches are added, use a fertilizer high in nitrogen. Broadcast fertilizer as needed at a rate of 1/2 pound of nitrogen per 1,000 square feet. Be sure to water the fertilizer into the soil to avoid direct contact between stems and the fertilizer.

Biennials

Biennials are plants that complete their life cycle in 2 years. They produce leaves in the first growing season, usually a rosette. In the second growing season, preceded by a cold period, they produce blooms and die. Obviously, the disadvantage is that biennials produce only foliage the first year with no blooms. For this reason, new varieties have been developed that produce early blooms. ‘Foxy’ is a variety of foxglove that blooms the first year. Biennial species can be planted in midsummer to force the plant to bloom the following year. Popular biennials are stock and hollyhock. Cultural practices are basically the same as for annuals except the plants live for 2 years.

Perennials

Perennials are plants that live year after year, such as trees and shrubs. Herbaceous perennials are those that die back to the ground each fall with the first frost or freeze. The roots persist through winter; every spring, new plant tops arise from the buried roots. In the

landscape herbaceous perennials often are just called perennials while woody perennials are referred to as trees, shrubs, ground covers, and vines.

The most obvious advantage associated with perennials is that they do not have to be set out every year as annuals do. Some perennials, such as dianthus, have to be replaced every few years. These are called short-lived perennials.

With careful planning, perennials offer another advantage—the flower bed can change colors as one type of plant finishes blooming and another variety begins to bloom. Also, since perennials have a limited blooming period of about 2 to 3 weeks, deadheading (removal of old blooms) is not needed as frequently to keep them blooming. However, they do require pruning and maintenance to keep them attractive. Their relatively short bloom period is a disadvantage. But by combining them with annuals, a continuous show of color can be achieved. Most perennials require dividing every 2 to 4 years.

Culture and Maintenance

Success with perennial flowers is an art and a science. Below are listed some of the scientific aspects of growing perennials.

Site Location

Many of the same aspects of site selection should be considered for perennials as for annuals: sunlight (full sun to heavy shade); slope of the site (affects temperature and drainage); soil type; and the role of selected plants in the garden. This is especially important with perennials, because they usually are left on-site for several years. In general, it is best to plant clumps or drifts of perennials rather than one plant. Make large plantings if space allows. An ideal location has a background, such as a wall or hedge, against which perennial blooms will stand out. In island beds, perennials can provide their own background when tall varieties are planted in the center and low ones toward the edges.

Soil Preparation

Preparing the soil is extremely important, because to perennials usually are not disturbed for 2 years or more. Many annuals can grow and flower in poorly prepared soil, but few perennials survive more than 1 year if the soil is not properly prepared.

If possible, begin preparing the soil for new beds well before planting time. First, have the soil tested. Results will indicate soil acidity and fertility levels. Generally, materials to adjust pH need time to work. Before preparing new beds, check the soil to see that it is well-drained, yet still has some water-holding capacity. Test for drainage in the same way as described for annuals. If drainage is inadequate, dig furrows along the sides of the bed and add soil from the furrows to the bed. This raises the level of the bed above the general soil level, and excess water can seep from the bed into the furrows. However, raised beds may erode during heavy rains. To prevent this, surround the beds with wooden or masonry walls. Since raised beds dry out more quickly than flat beds (little moisture moves up into the bed from the soil below), water raised beds frequently in summer. After forming the beds, spade the soil to a depth of 8 to 10 inches. Turn the soil over completely, incorporating 2 to 4 inches of organic material. Remove debris and leave rough during winter.

Just before planting, spade again and add recommended fertilizer levels. Be sure to work any phosphorus deeply into the soil where plant roots can reach it. Rake the soil surface smooth. After raking, the soil is ready for seeding or planting.

Selecting Plants

It is best to select plants for specific purposes, such as edging plants, accents for evergreens, masses of color, rock garden specimens, etc. Choose perennials by considering their characteristics and deciding which plants best meet these predetermined purposes.

To obtain details on particular plants or groups of plants, consult plant specialty books, nursery staff who specialize in herbaceous perennials, local botanical gardens or Extension agents.

Planting Times

Generally, late summer- or fall-flowering perennials are planted in spring, while spring-flowering perennials are planted in late summer or fall. However, it is wise to check exact planting dates for specific perennials. Regardless of planting time, allow perennials sufficient time to become established before they bloom or before the onset of cold weather.

Setting Out Plants

The procedure for planting perennials is the same as for planting annuals. Refer to the annual section of this chapter for planting details. Allow plenty of space between plants, because most perennials spread quickly and need room to develop. Perennials usually show up best when planted in clumps or groups of plants of the same variety.

Watering

Since herbaceous perennials grow back from the roots every year, it is important to encourage deep, healthy roots. Proper watering promotes good root development. When watering, make sure that all the roots are reached. Refer to the directions on watering in the annual section of this chapter. In New Mexico, water occasionally in winter since the root systems of perennials continue to be active through the dormant season.

Mulching

Mulch gives an orderly look to the landscape and reduces weed growth. Mulches are very useful in maintaining uniform moisture conditions in the soil, and they can affect soil temperatures. Bark, pine needles and shredded leaves are common organic mulches used in perennial beds. Organic mulches may add some nutrients and humus to the soil, improving its tilth and moisture-holding capacity. Most organic mulches should be applied after plants are well-established and when there is reasonably good soil moisture. Inorganic mulches, such as plastic films or paper, are applied before planting. Gravel and black plastic are commonly used inorganic mulches. All mulches require care to keep them attractive; litter is very noticeable.

Perennials should be mulched during winter months in those areas of New Mexico where soil heaving results from repeated episodes of freezing and thawing. However, be careful with winter mulching, because it can do more harm than good. Do not pile mulch too heavily over the crowns as this encourages rotting. Boughs of evergreens give ample protection and allow air circulation. Apply mulch around the plants only after the soil temperature has decreased following several killing frosts. If winter mulch is applied too early, warmth from the protected soil encourages new growth. Severe plant damage can result if this new growth is frozen back. Remove winter mulch as soon as growth begins in spring. If not, the new growth will have insufficient chlorophyll and will develop long, gangly stems.

Weeding

Follow weeding directions in the preceding section on annuals. A few preemergent herbicides are now registered for use with perennial flowers.

Fertilizing

Regular fertilization with a balanced fertilizer is necessary for perennials, since they rob the soil of its natural fertility. However, do not overfertilize perennials; a light fertilization program gives a continuous supply of nutrients to produce healthy plants. Broadcast the fertilizer through the bed in March. Repeat the application two more times at 6-week intervals. This should be sufficient to carry plants through summer. Apply another fertilizer treatment to late-blooming plants in late summer. Always water the bed after applying fertilizer. This washes the fertilizer off the foliage and prevents burn. It also makes fertilizer immediately available to the plants.

Deadheading

After perennials have bloomed, remove spent flowers. Cut flower stems down to healthy leaves or to the ground if there are no more buds. This keeps beds looking neat and prevents plants from wasting energy setting seed. Some plants can be forced to reblossom if severely cut back after the first bloom.

Disbudding

To gain large blooms from perennials instead of more numerous but smaller blooms, disbud them. Remove small side buds to allow the plant to concentrate its energy on producing one or a few large blooms. Chrysanthemums are perennials that are often disbudded.

Staking

Most erect perennials are top-heavy and all of the taller varieties need staking. If the plants fall over, the stem functions poorly where it has been bent. If the stem is cracked, disease organisms can penetrate the break. Stake plants when setting them out so that they will grow to cover the stakes. Once staked, tall perennials can better withstand hard, driving rain and wind.

Stakes can be made of any material and should be 6 to

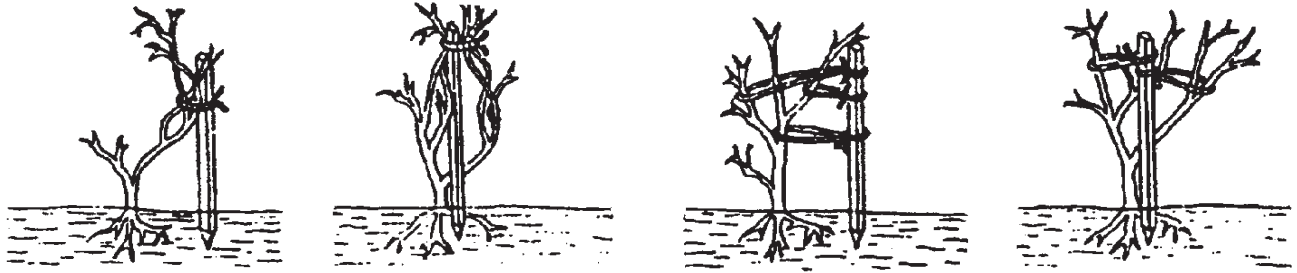


Figure 23. The plants on the left have been tied too tightly. It is better to loosely tie the principal branches, as shown on the right.

12 inches shorter than the height of the grown plant. Place stakes behind the plants and sink them into the ground deeply enough to be firmly embedded. Loosely tie plants to the stakes using paper-covered wire, plastic or other soft material (fig. 23). Tie the plant by making a double loop of wire with one loop around the plant and the other around the stake. Never loop the tie around both stake and plant. The plant will hang to one side and the wire may girdle the stem. Add ties as the stem lengthens.

Fall Care

In the fall, after the foliage of warm-season perennials has died, remove dead leaves, stems and spent flowers. These materials often harbor insects and disease-causing organisms. Apply winter mulch after the soil temperature drops.

Asexual Propagation

Much of the art associated with growing perennials has to do with propagation. Passing favorite plants along to friends and trading for a prized plant is part of perennial gardening. Understanding the art of propagation is a key step to experiencing the glory of perennial gardening.

Bulbs

In the broadest sense, bulbs include corms, tubers, tuberous roots, and rhizomes, as well as true bulbs. A true bulb is a complete or nearly complete miniature plant encased in fleshy, modified leaves called scales that contain food reserves. Corms lack these fleshy scales. They are the stem's base that becomes swollen and solid with nutrients. The tuber, an

underground stem that stores food, differs from the true bulb or corm in that it has no covering of dry leaves and no basal plant from which roots grow. Usually short, fat and rounded, tubers have a knobby surface with growth buds or eyes from which shoots of the new plant emerge.

In contrast, tuberous roots are the only bulb form that are true roots. Their food supply is kept in root tissue, not in stem or leaf tissue as in other bulbs. Rhizomes, sometimes called rootstocks, are thickened stems that grow horizontally, weaving their way along or below the soil surface and sending stems above ground at intervals.

Bulbs generally are grouped into spring-flowering (January to May) and summer-flowering (June to September). Spring bulbs provide early color before most annuals and perennials. One of the most popular spring bulbs is the tulip. However, in most areas of New Mexico, tulips should be treated as annuals since only a few varieties return for a second or third year, because of the relatively hot springs and mild winters. Tulips come in all colors except blue and are sold by type and variety. Some of the most common types include the following:

Breeder — bronzed (not clear colors)

Cottage — late-blooming

Darwin — tallest; wide flow

Lily flowered — petals recurve; bell-shaped

Parrot — twisted, ruffled, multicolored petals

Double — two or more rows of petals

Narcissuses, daffodils, and jonquils are classed by corolla length in relation to perianth segments. Colors include white, yellow, red, and peach. Some have become naturalized in certain areas. Hyacinths produce a large single spike of many small, fragrant flowers and come in a complete color range. Crocuses usually are grown for early bloom (often in snow). There are no red crocuses.

Selecting spring bulbs of good quality is very important, because the flower bud has already developed before the bulb is sold. Size also is important. Look for plump, firm bulbs. Select bulbs for specific purposes on the basis of color and size. For example, choose small bulbs for naturalizing and large ones to stand out as specimen plants. Keep bulbs cool (60° to 65°F) until planting. However, for tulips, the temperature must be lower (40° to 45°F).

Summer-flowering bulbs include amaryllis, crinum, caladium, dahlia, gladiolus, lily, and spider lily. Most perform as hardy perennials, and the roots successfully survive winter. However, the caladium and dahlia must be dug and stored or purchased and planted each year.

Culture and Maintenance

Bulbs are among the easiest flowers to grow successfully. The following hints may help guarantee success.

Storage

If bulbs are purchased before planting time, keep them in a cool, dry place. Temperatures between 60° and 65°F are cool enough to prevent bulbs from drying out until planting time. Temperatures higher than 70°F damage the flower inside spring-flowering bulbs. Rhizomes, tubers and tuberous roots are more easily desiccated than bulbs and corms and should be stored in peat, perlite or vermiculite.

Site Selection

In selecting a planting site, consider light, temperature, soil texture, and function. Most bulbs need full sunshine. Select a site that provides at least 5 to 6 hours of direct sunlight per day. Bulbs left in the ground year after year should have 8 to 10 hours of daily sunlight for good flowering. Bulbs planted in a southern exposure near a building or wall bloom earlier than bulbs planted in a northern exposure.

Adequate drainage is an important consideration. Most bulbs and bulblike plants do not tolerate poor drainage and rot easily if planted in wet areas. Function also must be kept in mind. If bulbs are used to naturalize an area, toss the bulbs and plant them where they fall to create a scattered effect.

Site Preparation

Good drainage is the most important factor for successful bulb cultivation. Dig bulb beds when the soil is fairly dry. Wet soil tends to pack tightly and retards plant growth. Spade the soil 8 to 12 inches deep. Remove any large stones or building trash, but turn under all leaves, grass, stems, roots and anything else that will decay. Add fertilizer to the soil as determined by a soil test. Place a 1- to 2-inch layer of organic matter over the bed. Thoroughly mix the fertilizer and organic matter with the soil. For individual planting holes, loosen the soil below the depth the bulb is to be planted. Add phosphate fertilizer and cover with a layer of soil (bulbs should not come into direct contact with fertilizers). Set the bulb upright with the pointed end up in the planting hole and cover with amended soil. Organic fertilizers in wet, hot summers retard blooming and promote disease, especially among gladiolus which are not dormant then.

Time of Planting

Hardy, spring-flowering bulbs are planted in late summer or early fall, while hardy, fall-flowering bulbs, such as colchicum, are planted in August. Plant tender, summer-flowering bulbs in spring after the danger of frost. Lilies are best planted in late fall.

Depth of Planting

It is best to check the correct planting depth for each bulb with a successful local grower or other reliable local source. Depending on soil condition, bulb catalog and reference book recommendations for planting may be either too shallow or too deep. As a general rule, plant bulbs to a depth of 2 to 3 times their diameter (fig. 24). In clay soils, shallower planting depths are recommended.

Watering

During dry weather, water the plants at weekly or twice monthly intervals, soaking the ground thoroughly. Be especially careful not to neglect bulbs after blooming. Watering is especially important the month

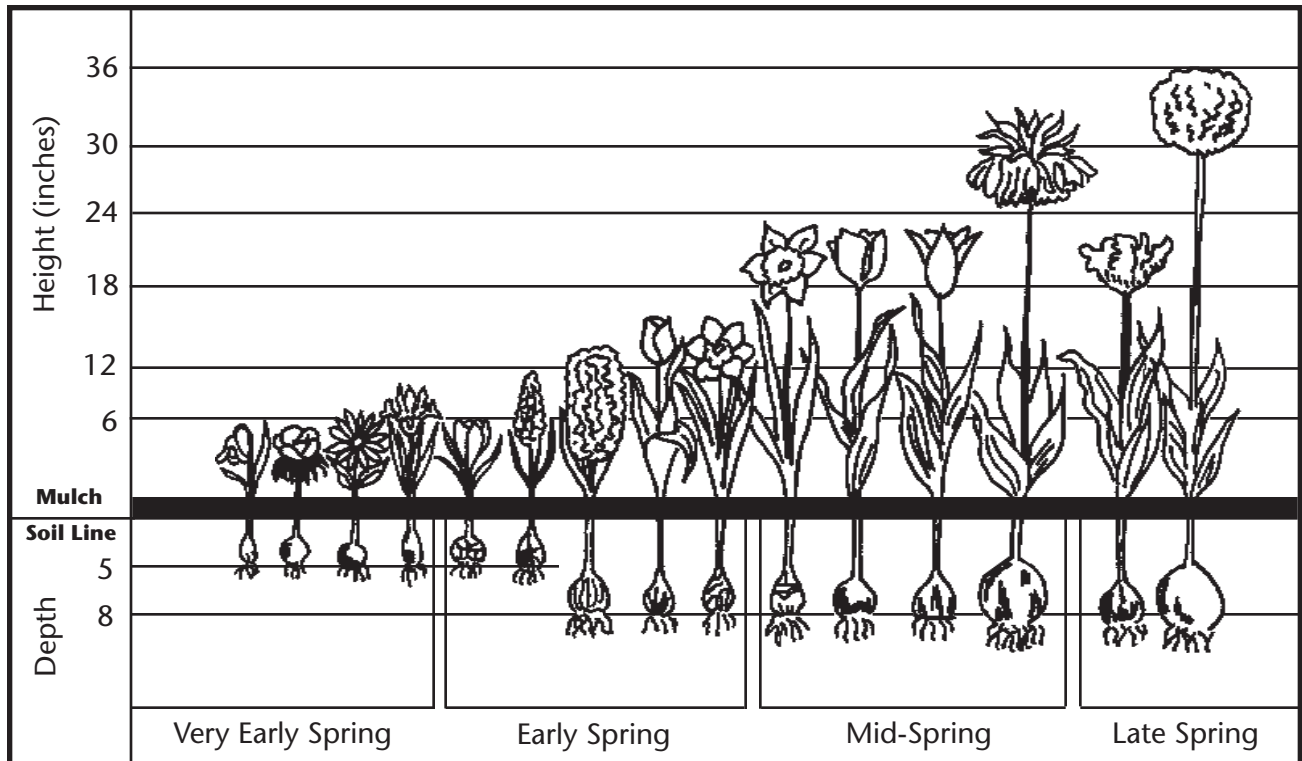


Figure 24. Bulb planting chart.

before flowering.

Mulching

In the winter, mulch bulbs 2 to 4 inches deep with an organic material, such as hay, straw or pine bark. Winter mulch prevents alternate freezing and thawing, which can damage bulbs and plant roots. Apply mulch after cold weather arrives. Bulbs may be damaged if mulch is applied while the soil temperature is still high. Remove mulch as soon as the danger of severe freezing has passed in early spring. If mulch is left on the ground after new growth starts, the tops of new shoots will be pale green or colorless, and new stems and foliage may be broken.

Fertilizing

After plants bloom, lightly fertilize with a balanced fertilizer. Avoid high nitrogen fertilizer. Be sure to keep fertilizer off the leaves and away from roots or it will burn them. In addition to balanced fertilizer, super phosphate can be used as a phosphorus source.

Staking

Some tall, heavy-flowered bulbs may require staking. If stems are allowed to fall over, they will be damaged, and the flowers will not show to the best advantage. Stake plants when they are emerging. However, be careful not to damage the bulb with the stake. For flowers that face one direction, use the stake to orient the face to the front of the bed.

Deadheading

When flowers fade, cut them off to prevent seed formation. Seeds take stored food from the bulbs.

Moving

If leaving bulbs in place to bloom next year, do not cut the leaves after flowering until they start to wither. Green leaves produce food for plant growth next year. After leaves turn yellow, cut and destroy the stems and foliage of the plants; dead foliage left on the ground may carry disease to new growth the following year. If

moving bulbs from one place to another or if a planting has become crowded and ceased blooming, move bulbs only after the foliage has faded. Bulbs dug and moved before foliage fades may not bloom the following year.

Digging and Storing

Many summer-flowering bulbs should be dug and stored since they are tender. This is done when the leaves turn yellow. Use a spading fork to lift the bulbs from the ground. Wash off any soil that clings to the bulbs, except for bulbs that are to be stored in pots or with the soil around them. Spread the washed bulbs in a shady place to dry. When dry, store them away from sunlight in a cool, dry basement, cellar, garage, or shed at 60° to 65°F. Avoid temperatures below 50° or above 70°F. Be sure that the air circulates around stored bulbs. Never store bulbs more than two or three layers deep as they generate heat and cause decay. Leave some soil on achimenes, cannas, and dahlias. Store these bulbs in clumps on a slightly moistened layer of peat moss or sawdust in a cool place. Rinse clean and separate them just before planting.

Pruning Landscape Plants

To prune or not to prune? This is a question gardeners often face. Many feel they should prune, but they are not sure why or how. Pruning is an accepted practice for the orchard and in the rose garden, but it may be rather haphazard in the landscape. Most often it is only performed when a shrub or tree begins to encroach on surrounding plants, a path, or a building.

What then is pruning? Why, when and how should it be done? Pruning is the removal of a part or parts of a woody plant for a specific purpose. This section explains the reasons for pruning, the proper techniques and when various types of plants should be pruned.

Reasons for Pruning

Pruning is done to train the plant; to maintain plant health; to improve the quality of flowers, fruit, foliage or stems; and to restrict growth.

Training Trees

The first pruning after trees and shrubs are received consists of removing broken, crossing, and pest-

infested branches. With trees, the traditional rule of pruning one-third of the top growth at transplanting to compensate for root loss is no longer valid for properly pruned, nursery-grown plants. According to recent research, excessive pruning at transplanting reduces plant size and does not aid in plant survival.

The central leader of a tree should not be pruned unless the leader is not wanted, as is the case with some naturally low-branched trees or where multiple-stemmed plants are desired. Trees with a central leader, such as burr oak, locust, cottonwood, or magnolia, may need little or no pruning except to eliminate branches competing with the central leader. These competing branches should be shortened. Some pruning may be necessary to maintain desired shape and to shorten extra-vigorous shoots.

The height of the lowest branch can range from a few inches above the ground for screening or wind-breaks to more than 7 feet above the ground near a street or patio. Removing lower limbs usually is done over a period of years beginning in the nursery and continuing for several years after transplanting until the desired height is reached. The concept in training a tree called "the trashy trunk" refers to this gradual raising of the lowest branches of a tree. Lower branches on the main trunk help create a thicker trunk more quickly. A common mistake in pruning young trees is to strip them of small branches, leaving only a tuft of leaves at the top of the tree. This training is incorrect and forms a weak, "buggy whip" trunk. Remove lower limbs when they reach 1 inch in diameter. This prevents permanent scarring of the trunk caused by removing larger limbs.

Another important concept in training trees is light versus heavy cuts. This refers to the length of the branch being removed and the desired growth response of that branch. If the terminal end is lightly cut back (less than 6 inches) on a young, vigorously growing branch, then lateral branching is induced up and down the branch. On the contrary, if this branch is cut back heavily (from 6 inches to several feet), the one or two buds located just below the cut are forced and grow at a very rapid rate. The importance of this pruning concept lies in the development of bushy, well-shaped trees through light pruning and the often desired, invigorating effect of heavy cuts.

For greatest strength, branches selected for permanent scaffolds must have a wide angle of attachment to the trunk. Branch angles less than 30 degrees from the main trunk have a very high breakage rate, while those

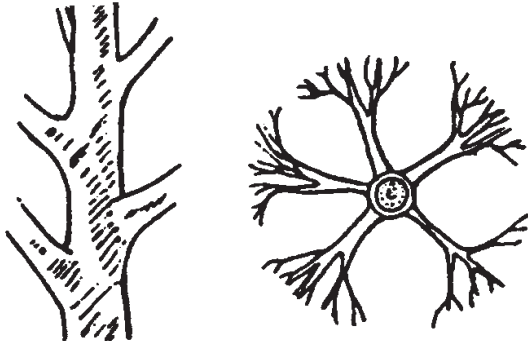


Figure 25. Scaffold branches of trees should have proper vertical and radial spacing on the trunk.

between 60 and 70 degrees have a very low breakage rate.

Vertical branch spacing and radial branch distribution are important (fig. 25). If this has not been done in the nursery, it can be started at transplanting.

Shade tree's major scaffold branches should be spaced vertically at least 8 inches apart and preferably 20 to 24 inches apart. Closely spaced scaffolds will have fewer lateral branches, resulting in long, thin branches with poor structural strength.

Five to seven scaffold branches should fill the circle of space around a trunk. Radial spacing prevents one limb from overshadowing another, which in turn reduces competition for light and nutrients. Remove or prune shoots that are too low, too close, or too vigorous in relation to the leader and to selected scaffold branches.

Maintaining Plant Health

In pruning to maintain plant health, the first consideration is sanitation to eliminate dead, dying or diseased wood. Any dying branch or stub can be the entry point or buildup chamber for insects or fungi that could spread to other parts of the tree. When removing wood infected by disease, such as a fungal canker or fire blight, it is important that the cut be made in healthy wood beyond the point of infection.

The development of a sound framework will help prevent branches from shading other branches lower on the plant. Evergreen shrubs will usually benefit from an occasional thinning of foliage. Thinning allows light and air to penetrate throughout the shrub, resulting in even foliage growth.

Improving the Quality of Flowers, Fruit, Foliage, or Stems

The more flowers and fruit a plant produces, the smaller they become, as seen on an unpruned rose bush or fruit tree. By reducing the amount of wood, pruning diverts energy into the production of larger, though possibly fewer, flowers, and/or fruit. Most flowering shrubs will bloom either on last year's growth or on new growth. Properly timed pruning increases the production of wood that bears flowers.

Restricting Growth

Over time, trees and shrubs often grow to sizes that exceed the space allowed for them. When space is limited, regular pruning becomes necessary to keep plants in bounds. Regular pruning is necessary on formal hedges to maintain a uniform growth rate. To reduce labor, select plants that will not exceed allotted space. Know the mature size of the plants and place them accordingly in the landscape.

Pruning Techniques

Over the years, pruning techniques from topping to hedge clipping have been debated. The following techniques are well-documented and provide guidelines in pruning trees and shrubs properly.

Pruning Twigs and Small Branches

When pruning twigs and small branches, always cut back to a vigorous bud or an intersecting branch. When cutting back to a bud, choose a bud that is pointing in the direction you wish the new growth to take (fig. 26). Be sure not to leave a stub over the bud or cut too close to the bud.

When cutting back to an intersecting (lateral) branch, choose a branch that forms an angle less than 45 degrees with the branch to be removed (fig. 27). Also, the branch that you cut back to should have a diameter at least half that of the branch to be removed.

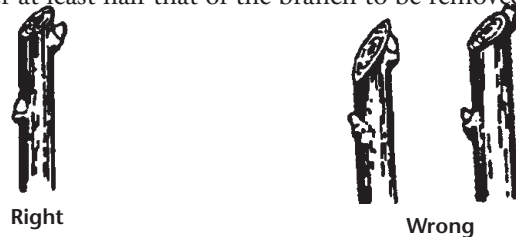


Figure 26. Pruning back to a bud.

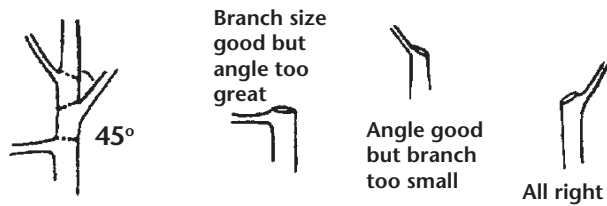


Figure 27. Pruning back to an intersecting lateral branch.

Make slanting cuts when removing limbs that grow upward. This prevents water from collecting in the cut and expedites healing.

Pruning Thick, Heavy Branches

According to Alex Shigo, former plant pathologist with the U.S. Department of Agriculture Forest Service, thick and heavy branches should be removed flush to the collar at the base of the branch, not flush with the trunk (fig. 28). The collar is an area of tissue that contains a zone of cells which prevent the passage of most diseases and insects. In the natural decay process of a dead branch, the decay advancing downward meets the internal protected zone, at area of very strong wood meets an area of very weak wood. The branch falls away at this point, leaving a small zone of decayed wood within the collar. The decay is walled off in the collar. When all goes according to nature's plan, this is the natural shedding process. When the collar is removed, the protective zone is removed, causing a serious trunk wound. Wood-decay fungi can infect the trunk easily. If the pruned branch is living, removing the collar at the base still causes injury.

When cutting branches more than 1 1/2 inches in diameter, use a three-part cut. The first step is to saw an undercut from the bottom of the branch about 6 to 12 inches out from the trunk and about one-third of the way through the branch. Make a second cut from the top about 3 inches further from the trunk than the undercut until the branch falls away. The resulting stub can then be cut back to the branch collar. If there is danger of the cut branch damaging other limbs or objects on the ground, it should be properly roped and supported, then carefully lowered to the ground after the second cut.

For over half a century, recommendations for pruning have been to flush-cut and paint. The flush-cut increases tree injury, and the paint only hides it.

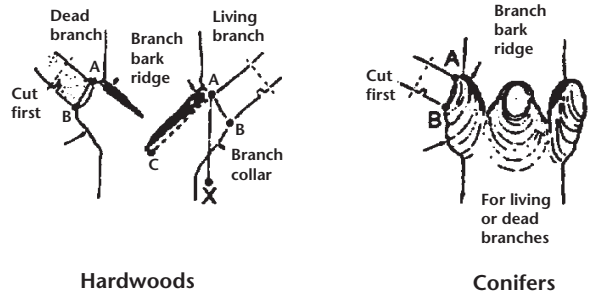


Figure 28. Shigo's method of pruning.

Pruning paint is primarily cosmetic, a psychological treatment for the person doing the pruning to show that he or she has done something to "help" the tree. In fact, paints or wound dressings may trap moisture and increase disease problems.

Topping Versus Thinning

All too often trees are topped ("dehorned") to reduce size or rejuvenate growth. In either case, topping is not a recommended practice. Topping is the process whereby a tree is cut back to a few large branches. After 2 to 3 months, regrowth on a topped tree is vigorous, bushy and upright. Topping can seriously affect the tree's structure and appearance. The weakly attached regrowth can break off during severe wind or rain storms. Topping also may shorten a tree's life by making it susceptible to attacks by insects and disease.

Thinning is a way to reduce the size of a tree or rejuvenate growth. In contrast to topping, thinning removes unwanted branches by cutting them back to their point of origin. Thinning conforms to the tree's natural branching habit and results in a more open tree, emphasizing the branches' internal structure. Thinning also strengthens the tree by forcing diameter growth of the remaining branches.

Pollarding

Pollarding is a pruning technique used extensively in Europe. It results in thousands of healthy trees lining city streets in what is considered a very adverse environment. For example, London planetrees have lived for 100 years while maintained by pollarding.

Pollarding often is confused with topping. Both techniques severely prune the tree back to large diameter branches. The difference is that with pollarding, follow-up thinning is performed 1 or no more than 2 years later. By thinning out the dense flush of new growth, the tree's integrity and strength are assured.

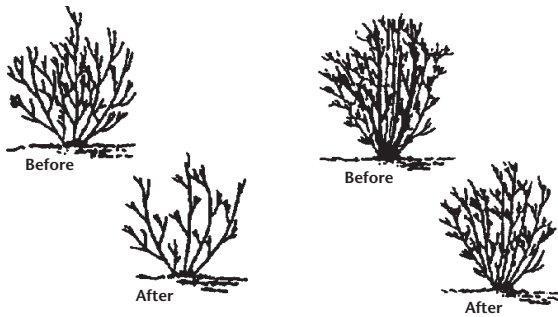


Figure 29. Deciduous shrub pruning.

Pruning Deciduous Shrubs

Pruning recommendations for most deciduous shrubs include thinning out, gradual renewal and rejuvenation pruning. In thinning out, a branch or twig is cut off at its point of origin from either the parent stem, a lateral side branch, the “Y” of a branch junction or at ground level (fig. 29). This pruning method results in a more open plant. It does not stimulate excessive new growth but does allow room for side branches to grow. Considerable growth can be cut off without changing the plant’s natural appearance or growth habit. Plants can be maintained at a given height and width for years by thinning out. This pruning method is best done with hand pruning shears, loppers, or a saw, but it should not be done with hedge shears. Thin out the oldest and tallest stems first.

In gradual renewal pruning, a few of the oldest and tallest branches are removed annually at or slightly above ground level (fig. 30). Some thinning out may be necessary to shorten long branches or maintain a symmetrical shape.

To rejuvenate an old overgrown shrub, remove one-third of the oldest, tallest branches at or slightly above ground level before new growth starts.

The general pruning procedure shown for crape myrtle (fig. 30) applies to many large shrub and small tree species. If a shrub is grown for its flowers, pruning must be timed to minimize disruption of blooming. Spring flowering shrubs bloom on last season’s growth and should be pruned soon after they bloom. This allows for vigorous summertime growth and results in plenty of flower buds the following year.

Most shrubs that bloom after June usually do so from buds formed on shoots that grew that same spring. Such shrubs should be pruned in late winter to promote vigorous shoot growth in the spring.

Pruning Evergreen Shrubs

For most evergreen shrubs, thinning is the most desirable pruning procedure. Some evergreens can be sheared for a stiff, formal appearance. However, they still need to be thinned occasionally.

Prune both evergreen and deciduous shrubs grown for foliage in late winter before new growth starts. Minor corrective pruning can be done at any time.

Pruning Hedges

Hedges are rows of plants that merge into solid linear masses. They have served gardeners for centuries as screens, fences, walls, and edgings.

A well-shaped hedge is no accident. It must be trained from the beginning. Establishing a deciduous hedge begins with selecting nursery stock. Choose young trees or shrubs 1 to 2 feet high, preferably multiple-stemmed. Cut the plants back to 6 or 8 inches when planting to induce low branching. Late in the first season or before bud-break in the next season, prune off half of the new growth. In the following year, again trim off half.

In the third year, start shaping. Trim to the desired shape before the hedge grows to its desired size. Never allow the plants to grow untrimmed to the final height before shaping. By that time, it is too late to get maximum branching at the base. Do not allow lower branches to be shaded out. After the hedge has reached the desired dimensions, trim closely in order to keep the hedge within chosen bounds.

Evergreen nursery stock for hedging need not be as small as deciduous material and should not be cut back when planted. Trim lightly after a year or two. Start shaping as the individual plants merge into a continuous hedge. Do not trim too closely, because many needle-bearing evergreens do not easily generate new growth from old wood.

Hedges often are shaped with flat tops and vertical sides. However, this unnatural shape is seldom successful. As far as the plant is concerned, the best shape is a natural form with a rounded or slightly pointed top and with sides slanting to a wide base (fig. 31).

After plants have been initially pruned to induce low branching, the low branching is maintained by trimming the top narrower than the bottom so that

Proper Method of Pruning Crape Myrtle



This plant, pictured before pruning, needs to have all weak and dead stems removed.



Same shrub after removal of weak and interfering wood and base sucker growth.



Results of proper pruning are graceful, vigorous growth with distinctive shape.

Improper Method of Pruning Crape Myrtle



Cutting at the dotted line is the usual course taken by those who prune shrubs.



The same plant after bad pruning, as indicated above. The sucker growth remains.



Results: The lovely natural shape of the shrub is lost, and bloom will be sparse.

Figure 30. Pruning of crape myrtle, other large shrubs, and small tree species.

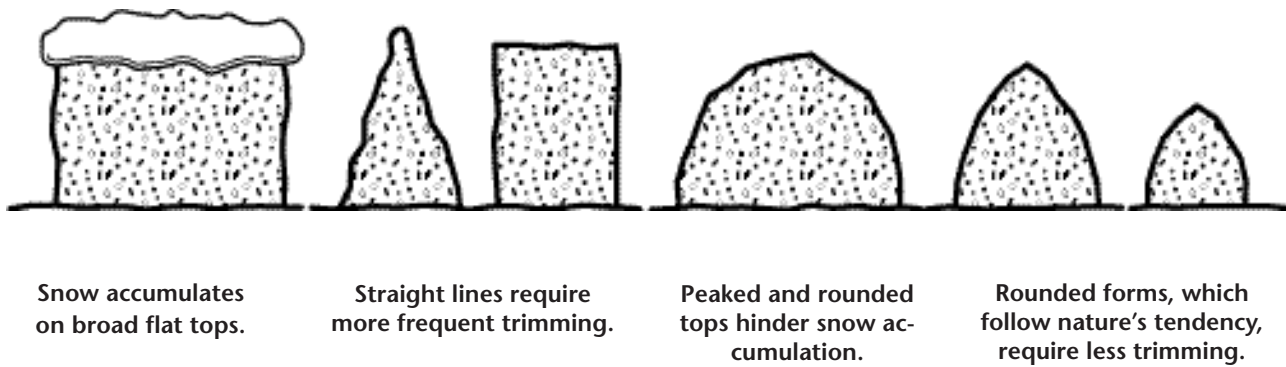


Figure 31. Hedge shapes.

sunlight can reach all of the plant leaves (fig. 32).

Gardeners often wonder how often and when to trim hedges. In general, trim before the growth exceeds 1 foot. Hedges of slow-growing plants, such as boxwood, need to be trimmed sooner. Excessive untrimmed growth will kill lower leaves and pull the hedge out of shape. Trimming frequency depends on the kind of shrub, the season, and desired neatness.

What can be done with a large, overgrown, bare-bottomed and misshapen hedge? If it is deciduous, the answer is fairly simple. In spring before leaves appear, prune to 1 foot below the desired height. Then carefully trim for the next few years to give it the desired shape and fullness. Hedge plants occasionally may decline too much to recover from this treatment, making it necessary to replace them.

Rejuvenating evergreen hedges is more difficult. As a rule, evergreens cannot stand the severe pruning described. Arborvitae and yew are exceptions. Other evergreen hedges may have to be replaced.

Tools

What tools should be used to trim hedges? The traditional pair of scissor-action hedge shears is still the best all-around tool. It will cut much better and closer than electric trimmers, which often break and tear twigs. Hand shears can be used on any type of hedge, while electric trimmers do poorly on large-leaved and wiry-twiggged varieties and sometimes jam on thick twigs. Hand shears also are quieter, safer and less likely to gouge the hedge or harm the operator.

Hand pruners are useful in removing a few stray branches and are essential if an informal look is desired. Large individual branches can be removed with loppers or a pruning saw. Chain saws are not recommended for use on hedges.

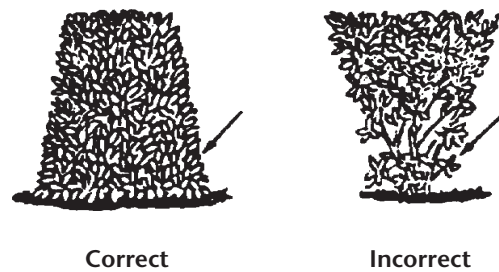


Figure 32. Proper hedge pruning.

