Livable LANDSCAPE DESIGN

by John F. Collins, ASLA, and Marvin I. Adleman, ASLA

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The purpose of this publication is to assist the homeowner, the landscape designer, and the landscape nurseryman/contractor in understanding and applying basic principles of design to the home landscape.

*Livable Landscape Design* is directed to those who may be changing or redoing the landscape for an existing home property as well as those who may be planning to build a new home. The process to be followed and the principles to be considered are similar in both cases.

A useful and attractive home landscape is the result of carefully planned, functional, and maintainable landscape design, not of exterior decoration or the employment of landscape "gimmicks" or fads. The primary message of this publication is that practicality, economy, environmental concern, and visual amenity are compatible and necessary for successful landscape design.

An understanding of environmental influences, design principles, and the basic design process will help the homeowner create a functional, easy-to-build and maintain, and, above all, more livable landscape.
THE LANDSCAPE
and the Environment

Imaginative, sensitive landscape design is compatible with and dependent on natural factors. In a time of increasing public alarm about major environmental problems such as groundwater and air pollution, soil erosion, deforestation, and the destruction of wildlife habitat, many people are surprised to discover that commonly accepted management techniques in the home landscape can contribute to these problems.

A landscape that is designed to be dependent on frequent irrigation misuses water, an increasingly limited resource, often diverting it from more important uses. When water supplies become limited, an irrigation-dependent landscape may have to be abandoned. Dependence on the use of power equipment for mowing, trimming, and other landscape maintenance functions may be unnecessarily wasteful of energy resources. A functional livable landscape can be designed without overdependence on water, energy, or chemical fertilizers.

Landscape design, installation, and maintenance are equal phases of a process in which every decision and action affects the environment. When we consider the cumulative, overall impact on water and air quality, wildlife habitat, and microclimate exerted by residential landscapes, it becomes clear that the actions of landscape designers, landscape contractors, and homeowners are vitally important to the quality of our future environment.

LOW-MAINTENANCE LANDSCAPE

Preserving or reestablishing selected elements of the natural landscape is relatively low in cost, and such a landscape can become largely self-maintaining. Fallen leaves, for example, do not have to be raked but instead can become layers of mulch that restore organic matter and nutrients to the soil. Native or naturalized vegetation is more likely to fit in visually with the character of the natural landscape and can provide food and cover for beneficial wildlife.
Landscape
TRADITIONS

Many of the landscape traditions and management procedures that are taken for granted in the United States are outmoded, wasteful of energy and money, and can be harmful to the natural environment as well as to public health.

The manicured lawn, for example, originated in England, where wet climate and heavy soils make turf grass almost self-maintaining. In the United States, the lawn has become symbolic of order, well-being, and respectability. Often, soil and climate conditions are not suitable for growing closely cut lawns. Under adverse conditions, the maintenance of turf grass may require vast quantities of water, fertilizer, limestone, herbicides, and pesticides. Turf grasses do, however, provide an excellent surface for many recreational and other outdoor activities, which may justify intensive management.

Many alternative ground-cover materials might be considered for areas where turf is not appropriate. Where it is possible, establishing an infrequently mown “meadow” area, using wildflowers, woody or perennial ground-cover plants, or simply permitting the natural forest mulch of leaf litter to remain in an area with many large trees can be more attractive and less costly than establishing and maintaining a lawn.

The pruning of shrubs into geometric shapes and the use of exotic plants that are conspicuously out of character with those that can be seen in the surrounding natural landscape are other conventions that are usually best avoided.

Foundation planting, the massing of shrubs around the base of a house, is a practice originally devised to mask unsightly exposed foundations. Most contemporary homes, however, are likely to be more attractive if the area where the house meets the ground is visible than if they appear to be engulfed by a “garden salad” of vegetation.

HIGH-MAINTENANCE LANDSCAPE

The planting of large areas of lawn, requiring mowing, leaf removal, watering, and the application of fertilizers and pesticides as well as the planting of trees and shrubs that require either constant pruning or watering are high-cost, high-maintenance approaches to landscape design.
BENEFITS of a Well-Planned Landscape

The Household
A well-planned residential landscape directly benefits the members of the household by providing increased opportunities for enjoyable outdoor living activities, greater privacy, a cooler indoor and outdoor environment in summer, reduced energy consumption in winter, an abundance of fresh food from vegetable gardens, vines, and fruit trees, and the pride and satisfaction of having developed an attractive, useful, and environmentally compatible site. The physical exercise of gardening and the joy of growing plants can offer great satisfaction and relaxation. Tangible results are produced in the form of seasonal color, food, fragrance, and visual delight.

If the level of maintenance is a major consideration during the design phase, substantial cost savings can be accrued over many years, often more than paying for the initial landscape installation. In addition, a notably higher property value normally results from an improved landscape, thus raising property values in an entire neighborhood.

To most people, the sign of a good neighborhood is a unified and cared-for landscape. In temperate climates, for example, large trees form the backbone of the landscape. If the landscape is dominated by trees that are native to the region, a distinct and special local character will be achieved.

The Neighborhood
Because your home is probably not located in isolation, the improvements you make to your landscape can have a ripple effect. The improvement of one property may inspire nearby homeowners to follow suit.

The Region
What you do on your land is likely to have a visual and environmental impact well beyond your property lines. Depending on the surfaces you use, rainfall will either penetrate into the soil and replenish groundwater or be carried off-site as runoff. By using as much porous surfacing as possible, you can decrease runoff and thereby reduce the possibility of downstream flooding, soil erosion, and siltation of ponds and lakes.

The use of local or on-site materials also preserves natural resources. A design that does not require fill or topsoil to be brought in or removal of material from the property prevents the damaging of other landscapes.

Planting native trees, shrubs, and herbaceous plants provides food and cover for local and migrating wildlife species.
LOCATION

Your landscape design should consider the regional character of your area. The climate will in part determine the extent and intensity of your use of outdoor space, as well as the choice of plant materials that are hardy in your area.

The topography, or landform of the area, will determine the use and character of the property to a large degree, and soil characteristics will dictate the quality of drainage, the degree of moisture retention, and the types of vegetation that realistically can be grown.

The native or indigenous plants found in your area are likely to contribute the most in forming the special local character of your region.

The direction of prevailing summer and winter winds and solar orientation are also important in designing a more livable landscape.

Wildlife is an important consideration in landscape design for many reasons, including the protection of plants and crops from pests. The provision of food, water, and cover for desired species should be incorporated where wildlife is to be encouraged.

Many of the examples referred to in this publication are based on the experience of the authors, primarily in the northeastern United States. The characteristics of each region, however, are different, and adaptation of this information will be required. Each distinct locale—desert, mountains, prairie, seacoast, or hill country—has its own special beauty. To build a California garden in Maine, or to try to establish a New England landscape character in Florida, will result in numerous design and management problems.

SIZE

Whether your property is a 100-acre farm or a 14-foot-wide row house in the heart of a city, the basic principles and design processes described in this publication will apply. An understanding of your household's interests and needs, combined with a careful study of the on-site and adjacent environment, can result in a design that is functional and enjoyable.

The size of an outdoor space is often not as important as how it is formed, what encloses it, and how the elements are arranged.

On a large property, often the best solution is to create small, human-scale spaces, with a strong sense of enclosure. On a very small property, the answer may be the opposite—to focus on a distant off-site view or to maximize the apparent size of the property through such design techniques as the use of very small-scale building materials and delicate plant textures.
Working with the natural environment need not be a complicated, scientific undertaking. With a simple understanding of the landform, soils, plants, water, climate, and wildlife characteristics, the designer can confidently work in harmony with the natural factors on any site.

The drawing on the following two pages illustrates a typical temperate zone marsh and hillside. To simplify the "reading" of this landscape, it is separated into four site types or subareas having similar landform, soil, plant, and water characteristics. The wildlife, climate, and visual character of each site type are mobile elements, subject to season, climate, and sight lines.
An environmentally sound design will produce a low-maintenance landscape that meshes with the natural conditions of the property. Rather than trying to change your site to accommodate the plan, let the site inspire the placement of the landscape elements.

Lawns, for example, should occupy only relatively flat, open, soft surfaces where people walk or play. Grasses, meadow wildflowers, and forest-floor ground covers require little care and are appropriate for rough surfaces where there will not be active use.

Trees and shrubs that are found growing naturally in your area are already adapted to local climate and soil conditions and are most likely to thrive with less care than exotic species. Use volunteer species to provide temporary shade and screening, removing them when more desirable species are large enough.

Study nearby woods and hedgerows to observe the levels of vegetative growth—canopy, understory, shrub, and her-
baceous layers. Such diversity and character can be reflected in your design.

Position plants to provide maximum solar access in winter, cooling shade in summer, windbreaks, insulation, privacy, and enclosure. To change the landscape, use existing resources—relocate soil and bury rubble to serve as fill. This practice reduces off-site damage and hauling costs. If organic matter is needed to improve poor soil, use compost, leaf mold, peat, or partially decomposed wood chips instead of importing costly topsoil. Wherever possible, choose plants that are adapted to soil conditions rather than trying to alter the chemical or physical character of the soil.

Porous paving materials such as bricks on sand rather than with mortar joints on concrete allow water to penetrate to the root zone of plants and reduce runoff. Grading paved and planted spaces to permit drainage to areas where infiltration can take place will cut down on erosion.
DESIGN STRATEGIES to Prevent Environmental Damage

Environmental damage is usually the result of ignorance of the sensitivities of the landscape.

The Existing Landscape
In the illustration, a successional old field meets a hardwood forest. A small drainage swale near the property line carries rainfall runoff to the marsh below.

1 Stream/swale
2 Existing woodland
3 Forest edge
4 Old field

Typical Environmental Damage
Many of the problems typically caused by construction and site development are the result of insensitivity to the site. Inadequate protection of soil surfaces causes erosion of banks and subsequent silting of swales and streams. Soil compaction and heavy equipment injure trees. Excessively steep slopes will result in continued maintenance problems, and improper compaction of the fill soil causes the foundation to settle.

1 Erosion of swale banks
2 Siltation of swale (pollution of streams)
3 Loss of protective vegetation
4 Creation of a lawn under trees changes pH and moisture levels
5 Trees damaged by grading equipment
6 Severe compaction caused by grading equipment
7 Fill over roots cuts off oxygen and water
8 Steep slope needs high-level maintenance
9 Erosion is a constant problem
10 Potential for settlement when building on fill
11 Unnecessary lawn requires high maintenance
Design Techniques

Many design and construction procedures can help to protect, restore, and add to the natural landscape character. The environmental benefits of improved water quality, habitat, and visual amenity are matched by a greatly reduced need for maintenance.

1. Existing swale protected to prevent erosion
2. Leaf mulch added to maintain moisture
3. Exposed trees wrapped to prevent sun damage
4. Snow fence to prevent compaction and damage to existing vegetation from construction equipment
5. Hay bale barrier to control siltation
6. Maximum slope of 2:1 to prevent erosion
7. Native shrubs for soil stability and wildlife habitat
8. Tall grass and wildflowers to control runoff
9. Stripped topsoil and litter used as landscape fill
10. Native tree planted for shade and privacy
11. Swale sodded to increase percolation
12. Foundation on undisturbed earth

Five Years Later

The environmental concern expressed in the design more than pays for itself in maintenance cost and visual quality. The forest edge has been restored, the swale has been protected, and the residents have an increased sense of privacy and direct visual contact with nature.
NATURAL FACTORS to Be Considered in Design

Landform
The form of the land—or topography—largely determines its potential usefulness. Excessive steepness or flatness limits activities and access and affects the maintenance level. The solar orientation of slopes is important to consider when planning an energy-efficient landscape and building site.

Landform determines whether a space will be open and expansive or private and enclosed.

Elevation above sea level is important in determining temperature, views, and potential flooding.

The cross-section diagram indicates varying slopes, classified by percentage or vertical drop in 100 feet. A 5 percent slope is considered the maximum for lawn games or parking; 10 percent is the maximum for most driveways or gardens; 20 percent is optimal for a split-level house; and 33 percent is the maximum for normal lawn maintenance. A 100 percent slope (1:1 ratio) should be protected and/or stabilized with vegetation.

The minimum slope for lawn areas to assure good drainage is 2 percent or 1/4 inch per foot pitch. A paved surface will drain with a minimum of 1 percent or 1/4 inch per foot pitch if carefully constructed.

Soils and Geology
An understanding of the soils and the underlying geology of your site is a factor in determining the landscape character and the best use of the land.

The quality and depth of topsoil are of obvious importance. Soil should be tested for pH (acid/alkaline range) and nutrient levels to determine what plants can be grown successfully and whether soil amendments are required. Soil testing is often available through Cooperative Extension in each state for a minimal fee.

The proportion of the major components of soil—clay, sand, silt, and organic matter—will determine the porosity, water-holding capacity, and general physical quality. Soils are classified by texture as, for example, clayey silt loam or sandy silt loam.

Soil is formed by two primary means: the decomposition of rock (forming mineral soil) and the decomposition of plant tissue (forming organic soil).

Peat is formed by decomposition of aquatic reeds and mosses over a prolonged period. Humus is formed by the annual buildup of leaf litter on the forest floor.

Topsoil is a major natural resource that should be carefully protected.
Plants

The native plants on your site or nearby can tell you a great deal about the soil, climate, and wildlife characteristics of the area.

Rather than look at the individual plant species, try to identify the various plant associations—the trees, shrubs, and herbaceous plants that grow together as a unit, determined by soil, water, and climatic relationships.

Keep in mind also that in regions where forests exist, the open land is continually attempting to return to a forest condition through the process called natural succession. By identifying the initial volunteer successional plants, the species that form the next stage, and the more permanent, longer-living "climax" species, the designer can use this natural energy to assist the design.

Both visually and for wildlife habitat, the forest edge, or ecotone, is usually the most valuable. Flowering trees and shrubs that are spindly and sparsely flowering in the understory are dense, profusely flowering members of the forest edge community.

The plants you protect or select will be the most important design elements in establishing the overall character and mood of your site.

Water

Understanding the natural water system of a site is of major importance in creating a landscape design. Maintaining adequate moisture and drainage, preventing soil erosion and stream siltation, and protecting the natural groundwater storage zones called aquifers are important parts of water management.

A watershed is the area within which water drains to a single water body or stream. The watershed for any site can be located on a U.S. Geological Survey map. The immediate watershed boundaries can be determined from an on-site survey or by observation.

The water table is the upper limit of soil saturated by groundwater and can usually be determined by making test pits. If a stream or river is within or close to the property, it is vital to know the levels of flooding.

To prevent excess runoff, consider the comparative levels of porosity of different landscape surfaces. Runoff is highest on pavement, followed by agricultural fields, lawns, meadow, and forest. Almost no runoff occurs in forested areas, where both tree cover and leaf litter intercept precipitation, allowing gradual infiltration into the soil. To protect the water table and groundwater aquifer, as much porous surface as possible should be included on a site, and fairly dense vegetation should be maintained.
Climate

Whether you are making changes in an existing home or siting a new one, your plans should include consideration of solar orientation, areas of partial and full shade, varying directions of summer and winter winds and storms, and potential for planted or built windbreaks, solar collectors, and summer shading from carefully placed deciduous trees.

Both the regional climatic conditions and the site microclimate should be considered. Frost pockets, wind eddies, snow drifting, and glare and heat reflected from buildings and paving all influence human comfort and plant survival.

The year-round temperatures in most cities average 5°F above those of the surrounding countryside because of heating and automobile emissions. One result is that plants that are tender for the region may be grown. Trellis structures, deciduous wall vines, overhangs, and earth berms can modify summer temperature and increase comfort.

Wildlife

The provision for adequate wildlife habitats is important to a balanced natural system. The places most often thought of by man as waste land—swamps, meadows, and thickets—are of highest value to wildlife species. Too often these habitats are destroyed to “improve” the appearance of the landscape.

The forest edge is the zone of highest wildlife activity, whereas the mature forest, where most branches and leaves are far above the reach of local wildlife, is virtually barren except for tree-dwelling species.

Food and cover for desirable bird and mammal species can be provided in many ways. Planting fruit-producing trees and shrubs, recreating a thicket condition, or permitting one area of the site to be maintained as a meadow are a few techniques.

Aquatic species can be attracted by providing varying water depths: 0–12” for emergent plants, 30–48” for bottom-rooted, floating plants, and over 60” for cool-water, submerged aquatics.

Watch for wildlife movement patterns to learn whether your site is part of a movement corridor for deer and other animals. If you wish to encourage them, protect or increase the density of vegetation along their route.

1. Cooling summer breezes
2. Open understory permits air movement
3. Angle of winter sunlight
4. Angle of summer sunlight
5. Roof overhang, screens, and setback for shade
6. Fitting house into earth for insulation
7. Roof angle for maximum sun
8. Swale for drainage
9. Planted buffer for windbreak
10. Cold winter winds
11. Crest of hill (avoid construction)

1. Freshwater pond
2. Pond edge
3. Marsh
4. Marsh fringe
5. Old field
6. Forest edge
7. Forest interior
The creation, use, and care of the landscape is a continuous, evolutionary process. Unlike the built environment, the landscape continues to grow, to mature, to die, and to give new life. In this publication, landscape design will be approached with this ever-changing process in mind.

Design decisions will continue to be made long after the completion of construction and planting because pruning, thinning, replanting, repair, and other maintenance will be required. Many landscape designs fail because the effects of time and this ongoing process are ignored. For example, rigorous trimming and pruning to keep plants the same size year after year may cause their disfigurement as compared to the more desirable maturing of plants into their natural form and structure.

The development process is described in four stages: design, protection/salvage, installation, and maintenance. Although this publication stresses design, the other aspects must be considered as equally important to an environmentally sound and livable landscape.
The first stage in the development of a landscape includes survey, analysis, and design. If possible, have a surveyor prepare a topographic survey or rent the necessary surveying equipment so that the grading and drainage design can be based on accurate information.

Field measurement and mapping should include all existing natural and man-made elements such as trees, shrubs, structures, and paving. In addition to the location, size, and type of plants and other features, their condition or quality should be noted.

After completing the preliminary design, stake out the design on the site to check the exact relationships between elements that are to be retained or salvaged. The design can then be adjusted if necessary before construction begins.

Determine the quality and quantity of topsoil, plants, paving, and construction material that can be salvaged and reused.

A logical, step-by-step approach, combining good site information with a clear list of priorities, can greatly improve the usefulness of the design.

The reuse of existing site resources and restorative pruning and grading can be the key to a successful landscape. The first step is to install protective temporary fencing around areas to be left intact or to place bales of straw as silt barriers where erosion or runoff may occur during construction.

Next, salvage trees and shrubs, soil, leaf litter, and construction materials and store them properly. Plant material should be placed in a shady location with mulch covering the root ball.

Prune and thin existing trees and shrubs, removing dead, diseased, or conflicting branches.

Dispose of excess soil or rubble on-site if possible, using the material as fill where needed.
STAGE 3 Construction and Planting

The third major stage includes grading, construction, and planting.

Landscape work should be done only in optimal weather to ensure that the condition of the soil, plants, and construction materials, especially concrete, are not permanently impaired. Wet soil can be seriously compacted by construction equipment, rendering it virtually impervious for years to come.

Soil must be prepared properly, especially for ground cover and plant pits. Without the right soil foundation, the desired results will be very difficult to achieve, even with extensive maintenance efforts.

Plant the largest trees first, then the next largest, and so on down the scale, installing ground-cover plants last.

Potential environmental damage is highest during the construction phase, so be on the alert for erosion, sedimentation, or compaction problems.

STAGE 4 Continuing Maintenance

Maintenance is the key to the success of the landscape development process. A plan that requires relatively low maintenance is much more likely to endure than one that requires excessive time or expense to maintain. The more natural an area is, the easier the maintenance will likely be.

Natural areas can be preserved fairly easily by judicious pruning. Pruning is one operation that is vital at all stages of the landscape development process and is one of the major keys to maintenance.

Encouraging volunteer plants helps the landscape to maintain itself. For a low-maintenance plan, lawn areas should be minimal because they require the most intensive and continual effort to maintain.
Consider your property as if it were a room or a series of rooms. Plan it just as carefully as you would interior space, considering the elements as walls, floor, ceiling, partitions, and furnishings.

The Floor
Paving, lawn, and ground cover are probably the primary “flooring” of your landscape. Level changes, slopes, steps, and ramps can be fit into existing topography, adding richness and interest to the space. A level change can provide the same functional separation as would an interior wall.

The Walls
Fences, walls, hedges, or planted screens can form the walls and partitions of your landscape. Their heights can be varied to fit conditions: to open a narrow vista, to screen a neighbor’s second floor window, or to provide a windbreak from winter winds.

The Ceiling
Trees, trellises, arbors, and the ever-changing sky are the choices for the landscape ceiling. The infinite variations of density, shading, texture, and seasonal color that a trellis structure can provide are often not fully used in contemporary design.

Furnishings
Benches, lawn furnishings, lights, sculpture, and other outdoor elements should be selected for comfort, ease of maintenance, and color. Form compatibility among the elements is also important. Earth tones (browns, tans, ochre, and warm grays) are restful colors. Red, orange, and yellow can be used for accent.

THE DESIGN PROCESS

The following ten sequential steps are outlined as a basic process in creating a detailed plan, ready for implementation for creating a livable landscape for an existing home.

Step 1
Make a Survey

Step 2
Develop a Base Plan

Step 3
Inventory the Site

Step 4
Analyze the Site

Step 5
Develop a Program

Step 6
Create a Functional Diagram

Step 7
Develop a Concept Diagram

Step 8
Sketch Alternative Plans

Step 9
Create a Master Landscape Plan

Step 10
Implementation Drawings: The Final Design
Before developing a plan, study the site carefully, considering the following points.

1. Locate major trees to be saved and protected.

2. Select trees and shrubs suitable for transplanting and reuse.

3. Check topsoil depth, pH, and nutrient levels.

4. Locate property corners and existing structures.

5. Note significant topography and drainage features, including steepness of slope and flow of water across or through the site.
The design equipment you will
need includes an architect's
and engineer's scale, a sheet of
transparent grid paper, a roll of
yellow tracing paper, soft and
hard pencils, drafting tape, a
straight edge, plastic triangles,
and a soft eraser. All of these
items can be found at an art
supply store.

Using the transparent grid
paper, plot your property line,
house (including all doors and
first floor windows), steps,
walls, fences, paving, trees,
shrubs, and any visible utility
valves, vents, inlets, and hose
connections. If you can locate
underground utilities, plot
them on the plan.

The scale of your plan de-
PENDs on the size of your prop-
erty and how it will fit on a
drawing. For small properties,
a scale of 1/4 or 1/8 inch equals 1
foot (on the architect's scale)
works well, whereas for a large
site 1 inch equals 10 feet or 1
inch equals 20 feet (on the en-
gineer's scale) may be neces-
sary to fit on a workable size
sheet.
Inventory the Site

To understand the characteristics of your property, you need to study the "building blocks" of the land. Knowledge about the soil, landform, plants, and drainage conditions will facilitate planning a landscape that fits the site. It is also important to understand the "built," or man-made elements, including buildings, walls, fences, paving, steps, and underground utilities.

Using an overlay of yellow paper on top of the plan of the existing conditions, identify the positive and negative features of your property. Consider views as well as views from the site. Note the natural features: soil condition, plants, drainage, wind directions, the noisy neighborhood dog, or the broken-down fence. Check the views from within the house as well as the walking patterns and entrances. Identify areas where privacy is disturbed, that are always in shade, or that have the best sunlight.

Mark all these features on the overlay so they are visible when a new sheet of transparent tracing paper is applied on top of it to work out a design.

The following examples show separate plans for each major site factor. You need not make up individual sheets for each example. The idea is to gather the required information and determine the relative importance of each element.
Soil

Your county Cooperative Extension agent or Soil Conservation Service Office can help you determine the type and character of soils in your area, test soil samples for fertility and pH, and advise on possible problems, remedies, and soil amendments.

Plants

Note the species, size, condition, and location of all major trees and shrubs and indicate their approximate branch spread. Investigate the plants in the neighborhood that are growing well and/or are dominant. Make a list for future reference.

Landform

The topography will influence the basic "form" and, in many cases, the usefulness of various areas. Use a line level or a level and string line to approximate changes in grade, using the floor level of the house as the benchmark. If available, a surveyor's level or transit is more accurate and will help in providing a precise topographic survey.
Water
The amount of rainfall and snow and how it is removed from the property or percolates into the soil is of major importance.

During a rainfall, plot the areas of runoff concentration and follow the water to where it leaves the site. Make note of high and low points, puddles, inlets, and watershed boundaries, the lines that divide areas of separate runoff direction.

Views
Preservation and enhancement of good views and screening of unsightly views are important in the design. Check different viewpoints from standing as well as sitting positions and from inside the house. Locate specific points where privacy is interrupted, such as from a neighbor's yard or windows.

Climate
The prevailing summer and winter winds are often from different directions. This information can be used to increase the year-round comfort by proper placement of screens, windbreaks, and openings. A nearest weather station can provide information on prevailing seasonal wind direction.
Step 4

Analyze the Site

The most important part of site analysis is to determine the natural and man-made factors that are really important to the design and their interaction with one another.

The designer should note the major positive and negative factors and the strong environmental considerations on an overlay sheet. The composite analysis plan should be clear and simple, so that it can be used as the base sheet over which design alternatives can be tested.

If all design work is done on top of the composite analysis, the tendency to overlook or forget important existing site characteristics will be avoided.
Develop a Program

The particular needs and interests of the members of the household should determine the functions to be accommodated on the site.

The program should list desired site uses in order of importance, such as sitting, entertaining, growing a vegetable garden, storage, or play. The size of each area or element can be determined, based on the number of people using it, the level of interest, and the space available. See the space-planning guide on page 29 for the sizes of many outdoor uses and facilities.

Write down the requirements of each element. For example, the vegetable garden needs good soil, relatively flat land, sun, and protection from wildlife. The outdoor dining space requires a hard, level surface, some shade, some sun, proximity to the kitchen, and privacy from the adjacent neighbor’s view.

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<thead>
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<th>REQUIREMENTS</th>
<th>IMPORTANCE</th>
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<td>Habitat for birds</td>
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<td>Storage (tools/toys)</td>
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<td>Compost pile</td>
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<td>Potting table/shed</td>
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<td>Cold frame</td>
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Create a Functional Diagram

In planning for outdoor activities and traffic patterns, related functions should be planned as a unit—for example, driveway, entrance path, and entry court (the arrival sequence); or vegetable garden, compost pile, wood pile, and trash storage area (working functions). The entrance sequence should be a welcoming, visually open, attractive area, whereas the work and storage areas should be removed from general view and day-to-day outdoor living.

Use of Space

The open, expansive front lawn is considered standard for many properties, and zoning laws normally require a building setback. This space is usually wasted, of no real visual or functional value to the residents, a virtual no-man's-land. Use of the front lawn area for recreation, as a garden, or as an enclosed, private courtyard can considerably expand the living space of the site.

In the back yard, outdoor activities are often severely limited because of poor relationships between house and yard. Differing levels, steep slopes, or lack of privacy can prevent comfortable outdoor dining, relaxation, recreation, or entertaining. The use of raised decks, fences, trellis work, or screen planting can often dramatically change the usefulness of the back yard space. In some cases, removal of fences between properties, especially at the rear, can expand otherwise useless space into functional and visual assets for both property owners.

The side yards of a suburban residence are often wasted space, unless densely planted or fenced for privacy. Rarely is this space used for outdoor living. Instead, it acts as a buffer, much as the front yard does. Without visual screening, however, there is no buffer; distance alone does not ensure privacy. Children's play areas, gardens, work areas, and outdoor patios can be placed in a side yard if respect is shown for the neighbor's view and privacy.

Indoor-Outdoor Relationships

The interrelationships of indoor and outdoor space are too often ignored. The surrounding landscape should be perceived as valuable living space and an extension of the house. Points of access, doors, windows, grade conditions, steps, and the interior layout should be carefully plotted on the initial base plan to facilitate a cohesive indoor-outdoor landscape design.

Try to relate outdoor functions as closely as possible to related indoor functions; store firewood near the fireplace, place outdoor dining close to the kitchen and children's play area within view of the kitchen window and near a "mud room" or secondary entry.

Placing trees and shrubs near the property lines (instead of against the house as foundation planting) screens the more private areas in the house while permitting views into the landscape from within the home.

Trellis structures, decks, fences, and other "half landscape-half building" elements can increase indoor-outdoor relationships, both visually and functionally.
Space-Planning Guide

The following drawings show reference dimensions for use in space planning.

**PLANT BED** [two-sided]
Maximum width of two-sided bed that can be easily maintained.

**PLANT BED** [one-sided]
Maximum bed width where access is from only one side.

**SHRUB SCREEN** [lineal]
Minimum width required for single row of large shrubs or evergreen hedge.

**COLUMNAR SHRUBS** [lineal]
Narrow, upright shrubs need much space to provide a screen.

**FLOWER BORDER**
Minimum width bed. Easily maintained.

**VINES** [grape, clematis, ivy]
Maximum spacing for vines planted along fences or walls.

**HEDGE** [single row]
Suitable for normal hedge installation. (Slope sides back for light.)

**COLD FRAME**
This plan assumes 8' x 8' x 16' concrete block walls with a 3' x 6' standard greenhouse sash cover.

**COMPOST ENCLOSURE** [masonry]
Two compartments (concrete blocks stacked loosely), one emptied each year, provide continuous humus.

**CORD OF WOOD**

**TABLE FOR TWO**

**TABLE FOR FOUR**

**TABLE FOR SIX**

**TABLE FOR EIGHT**

**TRASH STORAGE** [double]

**COMPACT AUTO**

**FULL SIZE AUTO**
Develop a Concept Diagram

Using the program, begin to test different locations for the desired improvements. Use a soft pencil, sketching very roughly on the overlay. You are trying to create a functional concept diagram, not a real plan, so be flexible.

Develop two or three concept diagrams that have promise (it may take several tries). Be sure to include the walking pattern between or through the various use areas. Discuss these concepts with the family and decide which is the most satisfactory. Test this once more in a sketchy plan drawn to scale.

Form

The designed landscape forms should relate to the architectural forms and property lines. Avoid wasted space resulting from irregular shapes.

First, work out the form of the various use spaces and walkways in a rough fashion. Then, on an overlay, give more definitive shape, using either geometric or curvilinear forms to express the materials you contemplate using.

Form needs to be thought of in three dimensions, keeping in mind eye-level views when placing elements. The features used to define the edges of each area or enclose the space should be considered carefully.

Texture

Landscape materials offer an infinite variety of textures, which can be used to reinforce the intent of the design. Fine-grained, intricate, textured plants such as ferns add great richness and detail. In small spaces, these plants can give a feeling of greater space. In general, coarse, large-scale elements—plants, paving, and vertical surfaces—work better in generously scaled spaces, and the treatment of a very small space is best handled with more delicate, fine-textured materials. The use of fine textures in the background and larger textures in the foreground increases the sense of distance. Generally, plant combinations work better with larger textures seen against a background of finer textures.

Scale

Let the scale of elements express open or intimate spaces. A small place seems larger if the elements are fine-grained and vice versa. Scale is extremely important in plant selection and location. Consideration of growth rate and nature size is vital.

Color

Color can have a marked effect on the character and mood of an outdoor space. Natural wood, brick, stone, and plant colors normally go well together. Painted surfaces should either blend in or serve as accents. Generally, green should not be used outdoors because, with the exception of some olive greens, this color tends to be incompatible with the greens of nature. Browns, red-browns, and other earth tones are more complementary to natural greens.

Cool colors such as blues and grays express a quiet atmosphere and suggest distance. Warm colors—reds, yellows, and oranges—are more active or festive and suggest closeness.

Natural local materials that stand up under harsh weather conditions are usually the most visually compatible and maintenance-free over the long run for paving, fencing, and site furnishings.
Sketch Alternative Plans

Select the most desirable concept diagram and test various design configurations, circulation patterns, and planting volumes. The two sketch plans express the same basic concept with different landscape forms.

Sketch A illustrates a rectilinear approach with right angles and hard edges separating lawn, paving, and plant beds. The edge of the wooded area is staggered so that the diagonal line of the woods is in a form sympathetic to the house and property. The outdoor spaces appear almost as separate "rooms" for each function.

The grading should complement the plan forms, so that both horizontal and vertical lines are of a similar character. Therefore, Sketch A should be handled with nearly flat planes, with crisp breaks in grade or stairs.

Sketch B uses softer, more organic or curvilinear forms to accomplish the same basic plan. This approach permits more flexibility and can respond to field conditions more easily. One drawback of a curvilinear concept is the loss of usable space, especially on very small properties.
Develop the concept plan in more detail to be sure everything fits. Don't worry about what specific shrub or tree you will use. Place plant forms to achieve the "walls," "ceiling," screens, windbreaks, and shading desired. Decide where plants are needed to serve specific purposes, not as mere decoration. Keep the plan simple. At a later stage, more refinement and detail can be included. Draw the car, tables and chairs, barbecue, paving, garden areas, and lawn in enough detail to show what they are made of and how they relate to one another. Shadows can help clarify the relative vertical size of landscape elements and can be used to make a plan more understandable or readable. If there are changes in grade, steps, or structures, study and draw elevation and section views at a larger scale.

Develop an overall compatible materials and furnishings "vocabulary" for use in finalizing the design. In addition to selecting each separate element, it is important to study the way they look and work together.
The Final Design

Once the overall placement of use areas, circulation patterns, and major planting is determined, a detailed plan should be developed. An informal or flexible plan is easier to adjust than a formal one. One rock outcrop, water line, or electric conduit that was not evident during the design phase can destroy the symmetry of a very formal layout. A good landscape designer usually makes adjustments during construction and planting, so a highly detailed plan is not always necessary for most residential landscapes.

Indicate the critical dimensions, suggested materials, and grading information. Separate plans for layout, grading, and planting are often used to describe the work more clearly, especially if the work will be done by separate contractors or if the design is complex. If it is a simple design, one plan will suffice.

The degree of detail of working drawings may vary from simple sketches if you are implementing the project yourself, to a fully documented set of drawings if the work is to be put out for competitive bid, in which case the working drawings are part of a contract and must be clear and comprehensive. Details of atypical built elements should be prepared.

**WOOD CURB DETAIL**

![Diagram of planting soil, timber, concrete, crushed stone, and reinforcement rod]

**Layout Plan**

This is the drawing used to establish all horizontal dimensions of proposed construction and planting. All the plan features, their materials, and plan relationships are indicated. References to details, special notes, and limits of responsibility should also be shown when applicable.

The layout, grading, and planting information can quite often be combined on one drawing if the design and construction process is simple. These are shown as separate plans for clarity and as an example of drawings for bidding by various contractors.
Grading Plan

The grading plan indicates the vertical dimensions, expressed in "spot elevations." The form of the finished surface is shown in contours. This plan example uses a one-foot contour interval. Existing contours are normally indicated as dotted lines; proposed grading is shown as solid lines.

The spot elevations are normally in feet and decimals of a foot. When it is necessary to be very accurate, hundredths of a foot are used. Although usually related to mean sea level, the spot elevations can be related to the floor level of the house, which can be established as 100.00 as shown on this plan.

If underground utility work is to be included, it is usually best to show it on the grading plan, to assure coordination.

**UNDERDRAIN DETAIL**

- FACE OF WALL
- GRAVEL DRAIN
- CONCRETE
- 1/8"/FT.

PERFORATED PER COMPACTED
Planting Plan

The example planting diagram indicates the location and approximate desired spread of plants when established.

The quantity and key letters (for example, 1-RM means one Rhododendron maximum) are shown on the top of the line, and the size (for example, 4-5' H means four to five feet in height). The total quantities of each genus and species of various sizes are shown on a summary plant list.

It is important to coordinate the planting plan with the layout and grading plans to avoid conflicts with grading and underground utilities.

Notes should also specify any special soil preparation, thinning, or pruning of existing plants.

PLANT BED DETAIL

- Prune only at
- 2" mulch as
- groundcover
- Turf grass
- Prepared soil
- Scarify sub
- Exist. subsoil
SITE PLANNING
for a New Home

Although this publication deals primarily with landscape development on an existing residential property, the process and principles apply to the development of an environmentally sound plan for a new home as well. Compare the aesthetic appeal of the standard approach to siting a home with a plan that meshes with the environment.

Standard Subdivision Controls

The rigid geometry of most subdivisions has resulted in the monotonous, rigid, and environmentally harmful development of much of suburban America.

The normal front setback, based on an arbitrary dimension, usually places the house far back on the property, forcing additional clearing and reducing the usable rear yard area.

Standard Site Plan

Sun, wind, views, drainage, privacy, and existing vegetation are ignored in this site plan. The landscape designer's task is remedial, and high costs are the result.

Foundation planting and the expansive, carpetlike lawn are deeply ingrained in the American tradition. Such a plan could require the needless clearing of native trees and shrubs.

Environmental Plan

In locales where environmental concerns have been incorporated into subdivision regulations, more flexible designs are possible.

The house, driveway, lawn, and garden can be positioned to take full advantage of solar orientation, topography, vegetation, wind protection, and visual appeal. A 100-foot-diameter circle is indicated for siting the house. The line through the circle, which indicates the long axis of the house, shows the best orientation for solar, wind, and view considerations.

After road grading and lot corner stakeout have been completed, an on-site survey can be made to locate major trees, minor drainage swales, topography, and views. A normal survey excludes this information.

Concept Diagram

The diagram indicates the relationships of functional areas to the house and site. The major benefits are good solar orientation for indoor and outdoor areas, plant buffers for noise, wind, and privacy, a lawn sized for the intended activities, a protected and observable children's play area, an outdoor living and dining terrace, use of the carport to provide screening from the road, a short driveway paved with porous material, and a vegetable garden and compost pile near the house but out of view.
Site Development Plan

The plan details the interior layout and site improvements. Placing solid walls to the northwest and glass areas facing southeast will save on heating costs. Storage functions are on the northern side to provide insulation.

The design concept encompasses the following landscape elements:

A. Buffer of pine to deflect wind and create a visual screen from adjacent property.

B. Cleared edge of existing stand of trees reinforced with deciduous and evergreen shrubs to screen view and noise from road.

C. Large deciduous tree to shade living and dining rooms in summer and allow sun to penetrate in winter.

D. Existing forest edge retained, reinforced by deciduous shrubs, transplanted evergreen shrubs, and small trees.

E. Fruit trees and fruit-bearing shrubs.

F. Flowering trees and specimen trees for seasonal interest and color.

G. Evergreen shrubs to screen view from the road.
Staging

Budget and time constraints often prevent the completion of the proposed improvements all at once. If the plan is clear, the work can be staged over many years.

In the first stage, complete projects that will most immediately contribute to livability. The major “framework” trees should be planted early, even in areas where other landscape improvements are years away.

Scheduling

Whether a project is complex or simple, proper planning is essential. Bypassing seemingly trivial steps may have disastrous results. Using the best materials and tools and seeking expert advice are of utmost importance to a good finished product. Time spent researching in these areas is a wise investment.

The chart indicates the sequence of construction for a residential landscape.

1. Design and cost estimates
2. Subcontractors
3. Permits
4. Order materials
5. Salvage/protection
6. Demolition
7. Stakeout
8. Excavation/grading
9. Utility installation
10. Concrete footings
11. Wall
12. Brick paving
13. Carpentry
14. Plant bed soil preparation
15. Lawn soil preparation
16. Planting trees
17. Planting shrubs and ground cover
18. Sodding
SITE PREPARATION

Preconstruction tasks include planning a work schedule coordinated with seasonal constraints, early ordering of items that may take a long time to come, and confirming delivery dates for plants and building materials. Before any work begins, permits should be obtained; agreements with subcontractors concluded, and costs estimated.

Reuse of existing soil, plants, rocks, and building materials can enhance the design character and reduce costs. It may even be possible to transplant or collect plants from your site for later use or from other nearby sites about to be developed.

Recycled bricks, paving stone, and even concrete paving can add a feeling of age. New materials take a long time to acquire the lichens, algae, and weathering already present on salvaged materials. In many locales, used bricks are more valuable than new ones.

As a general rule, select plant and building materials that can be handled within your equipment, time, and manpower capabilities.

Leaf litter or natural mulch from the areas where new grading or construction activities will occur can be salvaged for composting and later mulching.

If you are not capable of doing all or some of the preparation work, hire a skilled, qualified specialist.

Contractors

If you need to hire subcontractors such as electricians, plumbers, or masonry specialists, ask them for written estimates based on your drawings. It is advisable to obtain bids from more than one subcontractor. One benefit of starting with a thorough and well-conceived overall plan is that you can get realistic competitive prices from qualified experts. For complicated jobs, ask the subcontractor for shop drawings or at least rough sketches with accurate dimensions taken in the field to clarify the scope of the work. The subcontractor should state clearly what will be done, what will not be done, and how much it will cost. Be sure the work is guaranteed, at least for a year. Some jobs are not large enough to make competitive bids worthwhile. The installation of a hose bib, a small area of paving, or a single outdoor light would best be negotiated with one reputable contractor.

Permits

Most municipalities require the owner to obtain a building permit, for which a fee is charged. The purpose of building and zoning codes is to safeguard the health and well-being of you and your neighbors. The building of fencing, pools, paving, decks, and walls is usually interpreted as construction. Be sure that you understand applicable regulations dealing with swimming pool enclosures, property line fences, and setbacks.

Water, sewer, electrical, and plumbing work also normally requires permits. The contractor is responsible for obtaining the permit for these jobs. Street tree planting (or removal) requires a permit in many locales. It is wise to allow sufficient lead time in obtaining permits because dealing with the bureaucratic process can be time-consuming and may cause problems if you are counting on planting at the proper season.

If possible, obtain a permit for the entire plan so as to avoid repeating what is a frustrating process.
Trees in Cut Areas
When the soil level in the vicinity of a tree is lowered, the major considerations for preserving trees are the retention of an adequate root system and water supply.

If some tree roots must be cut, prune selected branches to help compensate for the root loss.

Compaction and damage to surface roots should be prevented by fencing where feasible, erecting dry stone retaining walls to prevent additional cut for footings, and tunneling under major roots for utility lines.

Irrigation during construction and maintaining a thick mulch can often help substantially.

1. Existing grade
2. Dry stone retaining wall
3. Roots cut cleanly with shears
4. Pruning done to balance root loss
5. Tunnel dug under major roots when trenching
6. Trenches backfilled with topsoil
7. Temporary fence at dripline
8. Existing grade retained at dripline

Trees in Fill Areas
The primary considerations involved in saving mature trees when nearby soil levels must be raised are the protection of the root system and maintaining adequate water and oxygen levels in the root zone.

Compaction, cutting roots, and soil saturation are the major problems encountered in fill situations because the fill soil blocks the normal water and oxygen penetration.

Perforated pipe and gravel provide oxygen, the dry wall retains the embankment without cutting roots, and the fencing prevents compaction from heavy equipment during construction.

1. Existing grade
2. Paving grade adjusted to minimize cut
3. Perforated pipe in gravel trench for oxygen supply
4. Standpipe to surface for oxygen supply
5. Dry stone, battered wall tree well
6. Gravel blanket to provide oxygen and water supply
7. Topsoil layer for grass or ground cover
8. Temporary fencing at or beyond dripline
9. Existing grade retained at or beyond dripline
Protecting Trees from Construction-Related Damage

**Paving and curbing**
Excavating to make curb and paving to meet existing grades near trees may damage roots. The root zone can be protected by using a thin, porous paving cross section, adjusting the finished elevations to avoid excavation, and placing a precast or wood curb on the surface.

**Walkways**
The fill required to meet the desired elevation for the walkway at the left side of the drawing will cut off water and oxygen in the root zone. The roots can be protected by building a portion of the walkway as a wood boardwalk. Open joints between the boards allow rain to reach the ground.

**Walls**
Excavation for the footing of a reinforced concrete wall causes extensive root damage. A dry stone (or railroad tie) retaining wall can eliminate the need for a footing because the joints are open, permitting water movement and flexibility. A "batter" or leaning back of the wall face is necessary, as is mortaring the top stone.

**During construction**
During construction a great deal of damage can be done by storing impervious materials under trees. Compaction from the movement of heavy equipment can be a serious problem. Fencing the area within the dripline can prevent these problems.

**Soil Protection**

**HYDROSEEDING**
Hydraulically spraying a seed, lime, fertilizer, and mulch slurry on graded slopes in one operation is comparatively inexpensive and good for large or steep areas.

**NETTING OR BLANKET**
Placing netting or a blanket over seeded slopes reduces erosion, runoff, evaporation, and seed loss. Jute netting, fiberglass matting, excelsior blanket, glassroot, and burlap are all commercially available.

**SILT TRAPS**
Temporary silt traps to filter soil particles from storm water runoff, required in most areas during construction, can be easily built with straw bales or geofabrics supported by stakes.

**GRAVEL WEIR**
A temporary mini-dam placed across a drainage swale or ditch will also filter sediment from storm water runoff and reduce velocity and downhill soil erosion.
Landscape Salvage

The primary concerns in salvaging native plants are the selection of the proper size and species, proper transplanting procedures and storage techniques (heeling-in), and good maintenance.

Select plants that are not too large and that have fibrous or shallow roots, store in a cool, shaded area, transplant quickly during the plant's dormant periods, and protect roots from drying by using leaf litter, soil, or organic mulches.

**TREE SALVAGE SEQUENCE**

**Pruning and tying up**
In preparation for salvage, the plant should be pruned to compensate for the loss of roots. Pruning should preserve the natural character of the plant. Tie up branches with twine to prevent breakage and to provide space for digging.

**Digging and burlapping**
Digging should be done carefully to prevent excess root damage, and the root ball should be secured in burlap. The tree trunk should be padded with burlap to prevent tearing the bark. Lift the tree only by the root ball.

**Heeling-in**
If the site is not prepared for planting immediately, heel in the tree, covering the root ball with soil, leaf litter, or peat moss, and keep the root ball moist. Heel in the tree in an open, wind-free and shady location, as possible to harden off the plant.

**Planting**
After hardening off or when the site is ready, plant the tree, hack fill with prepared soil, water after the plant is completely installed, and mulch promptly.

**TREE SALVAGE METHODS**

**Hand**
Hand digging by a skilled nursery worker best accommodates plant characteristics, size, root depth, and soil conditions. Clean cutting roots and retention of a solid root ball are advantages of hand work. For large trees, it is best to combine hand digging with use of a trencher or backhoe.

**Tree spade**
When moving many trees, a tree spade may be more economical than hand digging. Trees being moved short distances may be placed directly in a hole without being wrapped in burlap. In clay soils a tree spade causes compaction.

**“U” blade**
A “U” blade digger is the fastest but roughest method of tree salvage. Back cutting the root ball is recommended to prevent tearing the root system. For relatively small trees (under 3 inch caliber) this machine works economically when dealing with large numbers.

**“Sugar-scoop” loader**
"Sugar-scoop" loaders can be used to move trees if the root ball is cut with a trencher or by hand. This method is usually a bit slower than the other mechanical methods, but it does not require specialized equipment.
ROOTSTOCK SALVAGE
Completely pruning a "leggy" plant (such as mountain laurel) and transplanting the rootstock can result in a dense, vigorous plant in a few years. Total pruning is also a good way to regenerate a weak or straggly stand of many shrub species to promote a dense screen.

TRANSPLANT SALVAGE
The collection or transplanting of easily handled, small trees and shrubs is an obvious way of obtaining native plants. Careful digging, handling, and planting procedures are necessary. Early spring is generally the best time for this method.

SPRIGGING
Fast-growing, vigorous plants can be propagated by placing cuttings taken in winter or early spring directly into the soil. An 8-10-inch-long cutting (1- to 2-year-old wood) is planted with three-quarters of the length buried. Sprigging is good for erosion control.

HARDWOOD CUTTINGS
Cuttings of deciduous shrubs and some trees taken during the winter or early spring from the previous year's growth can be rooted if kept in a cool (35-50°), moist sand and peat bed until warm weather.

SOFTWOOD CUTTINGS
This method is normally used mostly for evergreen shrubs and some trees. Cuttings are taken in late August or early September, placed in a moist sand-peat medium, and protected from sun and wind, usually under glass or in a plastic case to retain humidity.
**Grading**

**Existing Conditions**

This back yard has problems! The original developer left an improperly formed embankment and failed to provide proper drainage. The cellar is always damp, and when rainfall is heavy, it is flooded. He also left a pile of rubble. Because of these conditions, the site cannot be maintained and is virtually useless.

1. Original grade line
2. Eroding cut slope
3. Pile of rubble
4. Water settles in a low spot
5. Previous fill
6. Settlement at house wall
7. Water in cellar

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**Restored Landscape**

Existing materials, including the rubble as fill, have been used to transform this area into a usable space.

By excavating clean soil and adding amendments such as sand, peat, or compost depending on soil characteristics, space was made for disposal of the inorganic rubble. This rubble was also used to reshape the embankment, providing a more gradual and maintainable slope.

This job did not require the use of heavy equipment. Hand labor can often be better than tractors and bulldozers because it avoids the problems of vehicular access, travel time, and the soil compaction that result from the use of heavy machinery.

1. Repaired slope and added shrubs
2. Rubble used as fill
3. Rubble buried
4. Proper drainage created by regrading
5. Paved terrace built (fill compacted under paving)
6. Dry cellar
Pruning

Existing Conditions
The illustration shows many problems typical to an unmanaged landscape. The entire space is virtually filled with plants so that the back yard is difficult to use. Overcrowding, competition, lack of sunlight, sucker growth, and root damage are the primary problems.
The health, size, and relative importance to the landscape of each plant should be assessed to make decisions to prune, thin, head up, or remove those that are causing problems.

1 “Leggy” rhododendron
2 Bare earth because of excessive shade
3 Apple tree with top and ground sucker growth
4 Roses inappropriately located
5 Broken branches, sucker growth
6 Overcrowded tree
7 Conifer too close to house

Restored Landscape
The area is now a usable outdoor room, with adequate sunlight and open space for play and healthy plant growth.
The rhododendron near the fence was cut back almost to the ground to encourage vigorous growth. The apple tree has been pruned to provide adequate sunlight, and the sucker growth was removed from branches and around the base of the tree. There is now enough light for ground cover or grass to thrive.

To provide open play space, the roses were removed. The oak tree has been headed up or elevated to permit access to its base and to let in sunlight.
The spindly competing tree and the conifer have been removed and recycled as firewood, one of the benefits of a good annual pruning and thinning program.

1 Rehabilitated rhododendron
2 Ground cover
3 Pruned apple tree
4 Open lawn
5 Pruned oak
6 Tree removed
7 Tree retained
8 Conifer removed
9 Firewood from trees that were removed
CONSTRUCTION AND PLANTING

With careful planning, the construction process can be completed with a minimum of difficulty. Construction, however, can result in environmental damage, especially erosion, siltation, and soil compaction. Measures to protect soil, water, and plants should be taken before construction begins.

Consult the accompanying chart to schedule work in this stage.

1. Salvaged plants transplanted
2. Protected native plants
3. New plants introduced as needed
4. Stockpiled topsoil to be reused
5. Proper drainage assured by careful grading
Site before Construction

The cross-section and the back yard plan designed to improve it include many of the common elements of a residential landscape construction project.

The existing property is virtually useless because the relatively steep slope precludes recreational activity or outdoor dining.

The landscape plan provides for a wood deck contiguous to the kitchen, a densely planted slope down to a play lawn, and a vegetable garden.

Landscape design requires the ability to visualize not only what the completed construction will look like but also how the ever-changing landscape will appear 2, 5, 10, or 20 years in the future.

Good sketch plans, sections, perspective sketches, or models are the tools we use to help us in this visualization.

Plan to Be Implemented
Field Stakeout

Field layout and staking can be critical. Where possible, use offset stakes that can remain in place during all phases of the work. This will save a good deal of time and ensure accuracy. If a transit is not available, make a giant triangle, using a 3:4:5 ratio, for laying out right angles. Set grade stakes to indicate cut and fill depths. Use a long 2" × 4" with a 4' level to find grades for proper drainage of small areas. (Minimum pitches = ⅛"/ft. for paving, ¼"/ft. for lawns.)

Excavation and Grading

The two most important issues to keep in mind during excavation and grading deal with topsoil and compaction. The stripping and proper stockpiling of topsoil, or the subsoil that can be made into "topsoil" by adding amendments, are important.

Avoiding soil compaction in areas to be planted and achieving a high degree of compaction in areas where paving, steps, or walls are to be built are also of major importance. Excessive or insufficient compaction, depending on the situation, is one of today's most prevalent construction problems. Plants will not grow on soil where air and moisture cannot freely enter, and paving and other construction will always crack and deteriorate when settlement occurs. Avoid working with soil when it is very wet or frozen. Heavy, wet soil can be virtually destroyed by compaction, and frozen soil will not compact properly in areas where compaction is needed.

If tree roots must be cut during trenching or grading, cut them cleanly with shears or a saw to facilitate healing.

Structures and Paving

Include proper footings, expansion joints, and weep holes to avoid common construction problems. All masonry walls (concrete block, stone, or brick with mortar joints) require a footing that extends below the maximum depth of frost penetration in your area. Your Cooperative Extension agent or building inspector can advise you on the proper depth. The footing, normally concrete, must be placed on an undisturbed soil base, and you should not build walls that rest on filled ground.

Remember that all outdoor materials contract and expand with changes in temperature. Provide expansion joints every 20 or 25 feet for both walls and paving. This means that each section of wall or paving should be a totally separate piece of construction, isolated by a flexible joint filler for the full depth of the masonry or concrete material.

The movement of subsurface water is one of the strongest forces in nature. Unless ways are provided for water to move through a retaining wall, the buildup of water pressure behind the wall will eventually push the wall over. The provision of 2-inch diameter weep holes, every 4 feet or closer, is recommended for most retaining walls.

A good reason to use a dry retaining wall, or a wall built without mortar joints, as shown in the drawings, is that footings, expansion joints, and weep holes are not needed because the wall is open-jointed and able to flex with movement caused by frost and temperature change.

Much literature is available about the types of paving and the variety of available textures, patterns, and color variations. If runoff, drainage, and soil-water availability to plants are of concern, porous paving that permits water penetration is superior to impervious types. Even when installing porous paving such as brick, stone, or precast concrete on a sand bed, it is advisable to set forms to the proper line and grade to provide continuous guidance for each course of the work. A rubber mallet is best for securely placing small stones or bricks.

Porous asphaltic paving can be used for driveways, parking areas, and walks. Elimination of sand from the asphaltic mix leaves "pore spaces," which give it the porous quality. A 6- or 8-inch deep base of crushed stone or gravel provides a reservoir for the water that penetrates the paving.
Planting

The most basic and most important component of a successful planting program is proper soil preparation. Even with intensive maintenance, the best of plants will do poorly without the right growing medium. Both landscape contractors and do-it-yourselfers are most likely to cut corners in the areas of soil preparation and digging plant pits of the proper size.

Planting soil for most trees and shrubs should have good water-holding capacity (add peat, compost, or humus) and good drainage qualities (sand). Very sandy soils will benefit from the addition of organic matter.

Most trees and shrubs prefer a slightly acid soil; ericaceous broad-leaved evergreen shrubs and ground covers require a more acid pH. Lawns do best with a nearly neutral pH (6.2-6.8), which can be achieved by adding ground limestone if the soil is acid.

Your Cooperative Extension agent can recommend locally available soil amendments.

The best way to prepare plant beds for small shrubs and ground covers is to add the required conditioning amendments and fertilizer, then dig the entire area a full shovel depth, as you would a vegetable garden, mixing all the ingredients well. To avoid compaction, do not work in wet soils. Some landscape contractors plant ground cover after mulching to avoid having to mulch between each individual plant.

Remember during all phases of the planting operation—digging, handling, heeling in, and planting—that you are dealing with living organisms that must be protected from breaking, drying out, wind, sunburn, and overwatering. If plants must remain unplanted for more than a few days before planting, place them in a shaded location, cover the roots with soil, leaves, or peat, and keep the root ball and the branches moist.

Plant the largest trees first, followed by the next largest, and so on down to vines and ground cover plants so it will be easier to make final adjustments in position.

Wait to put water in the plant pits until after the plant is fully planted. A 2-inch-high ring of soil around the outer perimeter of the plant pit is necessary as a watering saucer. Mulch to a depth of about 2-3 inches (much deeper than this can limit water and air penetration). In areas prone to early frosts in full sun or subject to rodent problems, keep the mulch at least 2 inches away from the stems of shrubs.

Mulch newly seeded lawn areas with straw or hydro-mulch (a water-borne, fibrous paper product) to prevent erosion and provide shade for the new grass.

Use commercial sod for lawns only if you intend to provide the maintenance that will be necessary to keep it in good condition. Sod must be used when fresh, kept cool after placement by periodic water sprinkling (even after deep watering in hot weather), and protected from foot traffic for at least a month.
THE LANDSCAPE DESIGN VOCABULARY

Paving

BRICK
Usual patterns are (1) running bond, (2) header, (5) herringbone, and (6) basket-weave. A. Brick on concrete slab with mortar. B. Brick on gravel base with sand or sand cement bed and joints. Sweep dry sand or mix into joints.

CONCRETE
Some of the many textures possible with concrete are (1) trowel finish, (2) broom finish, (3) precast, and (4) aggregate finish. A. Provide 4-inch-thick expansion joints every 20 feet and against walls.

STONE
Stone paving can be set in various ways: (1) rectangular, (2) cut rectangular, (3) granite block, or (4) random filled. A. Stone on concrete base with mortar joints. B. Stone on sand with grass joints.

POROUS
Other choices for paved areas are (1) water-worn pebbles, (2) wood chips, (3) sand, and (4) wood decking. Advantages of these materials are their low cost and porous surface.

Porous Surfaces

BRICK ON SAND
Brick on sand is excellent paving for patios, walks, and light traffic areas. Edges need containment. Use a rubber mallet to firm bricks. The materials are relatively expensive, and careful workmanship is required.

REINFORCED TURF
Precast units with intermittent openings permit grass growth. This surface is good for light traffic areas.

CONCRETE INTERLOCKING BRICK ON SAND
Concrete interlocking brick on sand is excellent for heavy vehicular traffic loads. It is relatively inexpensive and easy to lay, and the color can be varied as required.

POROUS ASPHALT
Although still in the experimental stage, this material has high potential for large surface areas. It is basically the same material as blacktop without sand.
Grade Changes

**GROUND COVER—LAWN SLOPE**
For reasonable maintenance, use ground covers on slopes steeper than 2:1 (2 feet horizontally to 1 foot vertically). Grass can be easily maintained on slopes of 3:1 or less. Locate a drainage swale at the bottom of the slope where required.

**STAIRS AND LANDINGS**
Break up long runs of steps with landings. A 3-foot vertical climb in a single run is a recommended maximum. Do not join the adjacent paving to the steps. Compact the soil beneath the paving and steps and place footings in undisturbed soil.

**RAMP**
This ramp is the official maximum handicapped access, 1 inch of rise for every 12 inches of horizontal distance (or 8.3 percent grade). A landing every 30 lineal feet is required.

**RAMP STAIRS**
Ramp stairs are a comfortable and gradual way of making grade changes. Railroad ties or concrete curbs work well.

**STEPPING STONES**
When an irregular sloping condition and low traffic permit, stepping stones can be used for an informal, flexible climb.

**STONES RIP-RAP AND RUSTIC BANK**
Rip-rap is steeply sloping stone paving. Rock garden plants and vines can be planted in the joints. A 1:1 slope is maximum. Creating a rock garden effect, using big boulders and plants, will stabilize the slope. Bury the stones more than halfway to assure stability.

Curbs and Edges

**CONCRETE CURB**
Concrete curb is suitable primarily for vehicular traffic.

**CONCRETE EDGING**
Concrete edging is good for plant protection and minor traffic control.

**TIMBER CURB**
Treated timber, with steel reinforcing pins every 5 feet, makes good, rustic curbs or wheelsops.

**WOOD EDGE**
2" x 4" treated wood edging can be used to separate materials. Stake every 4 feet.

**BRICK CURB**
Brick curbing works well for pedestrian and bicycle control but not for cars.

**BRICK EDGE**
A horizontal brick edge is fine for edging lawns, gravel, or ground-cover beds.

**STONE CURB**
Stone curbing can be very good and more durable than concrete for minor traffic areas.

**STONE EDGE**
Granite block or bluestone makes good plant bed edging.
Grade Changes

**GROUND COVER—LAW SLOPE**
For reasonable maintenance, use ground covers on slopes steeper than 2:1 (2 feet horizontally to 1 foot vertically). Grass can be easily maintained on slopes of 3:1 or less. Locate a drainage swale at the bottom of the slope where required.

**STAIRS AND LANDINGS**
Break up long runs of steps with landings. A 3-foot vertical climb in a single run is a recommended maximum. Do not join the adjacent paving to the steps. Compact the soil beneath the paving and steps and place footings in undisturbed soil.

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**RAMP STAIRS**
Ramp stairs are a comfortable and gradual way of making grade changes. Railroad ties or concrete curbs work well.

**STEPPING STONES**
When an irregular sloping condition and low traffic permit, stepping stones can be used for an informal, flexible climb.

**STEPPED PLANTING BEDS AND WALLS**
By using multiple small walls and level changes, you can achieve inexpensive construction and an easy transition from one level to another. Raised plant beds are also easy to take care of.

**CONCRETE CURB**
Concrete curb is suitable primarily for vehicular traffic.

**CONCRETE EDGING**
Concrete edging is good for plant protection and minor traffic control.

**TIMBER CURB**
Treated timber, with steel reinforcing plus every 5 feet, makes good, rustic curbs or wheel stops.

**WOOD EDGE**
2" x 4" treated wood edging can be used to separate materials. Stake every 4 feet.

**BRICK CURB**
Brick curbing works well for pedestrian and bicycle control but not for cars.

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**STONE CURB**
Stone curbing can be very good and more durable than concrete for minor traffic areas.

**STONE EDGE**
Granite block or bluestone makes good plant bed edging.
Retaining Walls

MASONRY (brick-faced concrete block)
Vertical retaining walls are expensive but allow for the most usable space. A wall over 3 feet high must be reinforced. Weep holes to let water pass through the wall are essential. Footing must extend below frost depth.

TIMBER WITH TIEBACKS
Pressure-treated timber or railroad tie walls can be built without deep excavation for footings. Timber walls require tiebacks for, without them, the wall will have a short life.

STONE ▼
A dry stone wall is the easiest retaining wall to build by yourself. As each layer is finished, backfill and firm the soil behind the wall. No footing is needed, just a “toe stone” layer 6 or 8 inches below grade.

Fences

WOOD
A wood fence can provide complete privacy. Posts should be cedar or treated timber. Boards should be painted or treated with preservative.

PICKET
If visibility is desired, a low picket fence is an easy-to-build solution. Pickets can be made of 1 × 3’s, 1 × 4’s, or 1 × 6’s.

WIRE ON WOOD
A good trellis to grow roses, grapes, or vines can be created by mounting 2" × 4" turkey wire on a wood frame. Footings of posts should be 30 inches deep, set in concrete. Use galvanized nails and staples to attach the wire to the frame.

PIPE AND CHAIN
Pipe posts (2-inch diameter) and chain make a simple, inexpensive fence to protect a parking area or plantings near a public walkway.
Landscape Structures

DECK
The main reasons for building a deck are to provide contiguous, level outdoor space and to protect tree roots from the destruction that a paved surface would cause. Be sure that the joists are properly sized for the span. The illustration shows 2" x 10" joists, on 24" centers, with 2" x 4" decking. The posts are 4" x 4", set on piers anchored in concrete. A 2" x 8" plate securely fastened to the existing house wall provides necessary stiffness. Double 2" x 10" girders provide support for the joists.

STORAGE ENCLOSURES
Simple-to-build enclosures for storage of tools, furniture, and play equipment can free space in the house and keep the yard neat. If firewood is stored next to a building, leave air space between wood walls and the wood pile. Keep enclosures simple and build them of natural wood or stained in an earth tone color to blend with the landscape. Or an enclosure may be built as part of a fence.

Plant Containers

TRELLIS
Trellis structures can provide enclosure, shade, and privacy from above and add a new dimension to an otherwise problem site. Build the trellis of cedar or treated lumber, and set the posts on piers anchored in concrete. Be sure the trellis frame is in character with the architecture of the house. The simpler the design, the better, in most cases. Grapes, roses, wisteria, and clematis are some of the more successful climbing plants for use on a trellis.

Many plants can be successfully grown in containers. House plants can also be brought outside during the warm months. The depth of soil is important. General requirements are as follows:

Annuals: 8" deep
Perennials and vegetables: 12" deep
Small evergreen shrubs: 15" deep
Medium-sized shrubs: 18" deep
Large shrubs: 24" deep
An example of a potting mixture is 1/3 soil, 1/3 peat, and 1/3 coarse sand.

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PLANTS
Most of the major plant types available to the designer are described on these two pages.
It is important to choose plants that are compatible with each other and grow well together in nature.
To show the range within each tree and shrub category, the form and comparative growth after ten
years are indicated for four species per category.
Horizontal lines show five-foot increments. Trees are six feet high at planting time.

BROADLEAF EVERGREENS

Rapid
(15–20" per year)
SOUTHERN MAGNOLIA

Moderate (upright)
(10–15" per year)
ENGLISH HOLLY

Moderate (upright)
(8–12" per year)
AMERICAN HOLLY

Moderate (spreading)
(8–12" per year)
JAPANESE HOLLY

Moderate (upright)
(6–8" per year)
INKBERRY

Moderate (spreading)
(6–8" per year)
ROSEBAY RHODODENDRON

Slow
(4–6" per year)
MOUNTAIN LAUREL

Very slow
(2–4" per year)
RED AZALEA

NEEDLE EVERGREENS

Rapid
(18" and over per year)
EASTERN WHITE PINE

Moderate (columnar)
(12–18" per year)
CANADA HEMLOCK

Moderate (pyramidal)
(12–18" per year)
RED CEDAR

Slow
(6–12" per year)
WHITE FIR

Rapid
(8–12" per year)
CHINESE JUNIPER

Moderate
(6–8" per year)
JAPANESE YEW

Slow
(4–6" per year)
SPREADING ENGLISH YEW

Very slow
(2–4" per year)
DWARF YEW
DECIDUOUS TREES

AMERICAN PLANETREE
Very rapid
(over 36" per year)

RED MAPLE
Rapid
(24–36" per year)

AMERICAN LINDEN
Moderate
(18–24" per year)

WHITE OAK
Slow
(under 18" per year)

HOPA CRABAPPLE
Rapid
(18" and over per year)

SHADBUSH
Moderate (upright)
(8–12" per year)

FLOWERING DOGWOOD
Moderate (spreading)
(6–12" per year)

STAR MAGNOLIA
Slow
(5–6" per year)

DECIDUOUS SHRUBS

STAGHORN SUMAC
Rapid
(18" and over per year)

WITCHHazel
Moderate
(12–18" per year)

WINTERBERRY
Moderate
(6–12" per year)

MAPLE LEAF VIBURNUM
Slow
(3–6" per year)
Vines

Self-securing

VIRGINIA CREEPER (teudrils)
WISTERIA (twining)

Supported

CLIMBING ROSE OR FIRETHORN (not true vines)

Ground cover — high

RUGOSA ROSE

Ground cover — low

ENGLISH IVY, EUONYMUS

Grasses

ORNAMENTAL/ PRAIRIE
MEADOW WILDFLOWERS

PASTURE/FIELD

TURF GRASS
Lighting

**POST LAMPS**
Post lamps are best for general lighting and at entrances. Use low wattage to avoid glare. A post lamp should be 10 feet tall to extend the spread of light, discourage vandalism, and avoid eye-level glare.

**WALL/STEP LIGHTS**
A light built into the side of a wall is good for illuminating stairs, doorways, and gate areas. Have an electrician do the wiring. Spotlights or floodlights from a building to illuminate a yard may create glare from adjacent properties and streets.

**UPLIGHTS/SPOTLIGHTS**
Recessed lights are good for uplighting trees, walls, and buildings. They should not be placed where they are accessible to small children. Surface-mounted lights should be hidden to avoid glare.
Let Nature Guide

PLANTING POSITION

The Existing Forest Edge

The illustration shows a typical forest edge and the transition area from successional old field to climax forest. The edge is characterized by a gradual buildup from tall grasses to shrubs to flowering trees to the canopy trees of the mature forest.

The great diversity of plants at a forest edge provides flowers, berries, and a variety of fall colors as well as food and cover for wildlife.

Studying the relationships of the shrub, understory, and canopy layers in your area and the plants that form them will give you ideas about re-creating or interpreting this natural transition in your planting design.

A Planted New Edge

This illustration shows the planting of shrubs and trees to recapture the components and the scale of the forest edge as they exist in nature.

Planting in this stepped configuration makes all sizes of plants visible so that their flowers, fall color, and fruit can be enjoyed by the viewer.
Select Plants for a Purpose

One of the most difficult tasks in landscape design is the selection of plants. Everyone has favorites, and it is normal to place them prominently in the plan. This is usually a mistake.

The first planting design should not include specific species. Simply sketch plant forms or masses to provide screens, windbreaks, a focal element, a canopy or "roof," or a strong sense of enclosure. Only after the purpose of the plantings has been decided should selection of species begin.

The sketch plan should indicate the uses to which the ground surfaces will be put. The line between lawn, ground cover, paving, and plant beds—or the transition from one surface to another—is one of the most important design decisions because it will determine the basic form of the landscape. Too often, the lawn mower makes this decision for the owner.

Avoid planting shrubs in lawn areas; they belong in plant beds. Shrubs in a lawn increase maintenance and create a fussy visual result. Lawn grasses require a near neutral pH, whereas most evergreen shrubs need a fairly low or acid pH—another reason why they should not be mixed.

Avoid selecting too many species; a simple planting is usually more successful.

Establish a concept for the canopies, understory, and ground plane plants, considering sun, shade, wind, soil, drainage, and visual qualities.

Use the natural landscape as the inspiration for your design and material selection.
CONTINUING MAINTENANCE

Possibly the most important part of making a landscape plan is to consider long-term maintenance requirements. Careful planning, with maintenance in mind, can greatly reduce the amount of time and money spent for upkeep. Many ambitious plans are abandoned after a short time because they require complex and costly maintenance. A formal design usually dictates more maintenance than an informal one. An example would be the need to replace dead trees which have been planted in a uniform row, whereas in an informal planting the loss of one tree in a group may not be conspicuous. Formal hedges normally require frequent trimming, but an informally planted screen of mixed trees and shrubs does not.

Limiting high-maintenance turf areas to a functional minimum will also cut down on maintenance. Encouraging areas to regenerate a woody character, which is what the natural succession process does, usually results in a zone in which pruning is the only maintenance activity necessary. The leaves that drop in the fall can be left to contribute to the soil-building process, eliminating time-consuming raking, bagging, and trucking.

One of the more time-consuming and difficult landscape elements to manage successfully is a fountain or pool. Algae buildup, leaks, stagnation, and mosquito eggs often plague such structures. If you are willing to provide the necessary care, however, the sound, motion, and reflective qualities of water can be very rewarding.

Many people consider the maintenance and care of a garden to be a joy. If an herb garden, rose garden, grape arbor, perennial border, or other special landscape feature is desired, and the physical work involved in maintaining it is gratifying, it should be part of your landscape design.

For others, a no-maintenance landscape is the goal. There is, however, no such thing. Whatever the decision regarding the anticipated maintenance commitment, be realistic.

1. Prune interfering, damaged, or diseased branches.
2. Encourage native plant volunteers.
3. For natural area, retain leaf litter.
4. Maintain tall grasses on slopes and allow wildflower volunteers.
5. Keep lawn areas to a minimum.
Managing Natural Areas

Forests

**Thinning.** The sketch above shows a portion of forest with dead and diseased trees, an abundance of choking honeysuckle, and extremely crowded conditions. Young, vigorous climax tree species are threatened by competition from short-lived but faster-growing neighbors.

By removing the dead, diseased, or damaged trees and those that will cause problems in the future, the forest is preserved in good condition.

This type of maintenance, however, is recommended only for areas where visual, recreational, or safety considerations warrant.

Pruning. This illustration indicates an existing condition where damaged branches, interfering branches, and a large wound on the big tree present potential problems for the owner. The broken limb is potentially dangerous, and the overhanging branch is shading a young, vigorous hickory.

Clean pruning, flush with the nearest larger member, and streamlined trimming of the wound will promote health for the large tree, as well as permit better conditions for the adjacent trees and shrubs.

Meadows

The establishment and care of an open meadow can give great benefits by providing wildflower color, wildlife habitat, and lack of the intensive maintenance that a turf grass lawn requires. The runoff of rainwater from a meadow is also far less than from a lawn or paved surface.

Usually, one or two mowings a year, in fall or late winter, with a sickle bar or bush-hog rotary mower set at 6 inches, is adequate to prevent the meadow from getting out of hand. Time mowings to permit flowering and seed production of the meadow plants, for their beauty and to provide food for local birds and animals. Daisies, lilacs, phlox, and many other wildflowers can be mixed with the taller grasses such as fescues and buffalo grass. In areas where prairie plants once dominated the landscape, the use of native grasses and flowers is becoming very popular and should be investigated.

Tree and shrub volunteers, unless desired for specific locations, should be removed annually.

Old Fields

A successional old field is an unusually beautiful but normally short-lived landscape because it is the first vigorous step in the regeneration of a forest on vacated agricultural land. To maintain this landscape of grasses and flowering trees and shrubs can require a great deal of work.

Mowing must be done at least every two years, sometimes annually. Each year, remove some of the woody plants to maintain the density and scale of plants you desire. Most of the trees and shrubs in this plant association normally last only until the more permanent trees overtake and shade them out. By preventing this competition, the successional plants can develop into unique specimens.

Solidago species, the goldenrods, can be planted to slow the regeneration forces of the forest because they are strongly toxic to other plants. They can be used in the meadow as well. In many areas, goldenrod maintains the "old field" character for thirty years or more, compared to the very rapid succession of goldenrod-free areas, which can often be completely covered by trees in ten years, sometimes less.
Dunes and Bluffs

Two very special edges where land meets water are the bluff and dune areas. Bluffs are continually eroding, sometimes as much as 2 feet per year. The vegetative cover is extremely important in protecting these exposed cliffs from wind and water erosion.

The dunes, which protect inland areas from flooding, are both built and sustained by beach grasses. Dense stands of beach grass provide a barrier to the sea farther stronger than rock or timber jetties, walls, and groins. The special values and sensitivity of dunes are now more fully understood, and protective laws are in effect in most areas.

The planting of "Cape" American beach grass (Ammophila breviligulata) 12 to 18 inches apart will develop a dense root system that stabilizes the dune. The grass blades intercept wind-borne sand, continually building the dune height.

The slowing of bluff erosion can be accomplished by reinforcing the zone behind the lip of the bluff with dense, impenetrable thicket plants, such as blackberry, roses, or green briars. Beach grass or virginia creeper on the slope of the bluff can also slow the rate of erosion.

Woodland Wildflowers

A shaded wildflower and fern woodland area can provide great beauty and enjoyment. The main maintenance tasks, in addition to proper soil preparation and plant selection and installation, normally include periodic thinning of the canopy to permit adequate light, the addition of leaf mulch to assure adequate soil building, the prevention of compaction or breakage from pedestrian or vehicular movement, and the removal of competitive or invasive species.

Many ferns or wildflowers are easily collected or may be purchased from commercial growers. Before undertaking the field collection of plant materials, familiarize yourself with state laws that protect many wildflower and fern species from any disturbance.

Mixing wildflowers and non-native flowers such as tulips or hyacinths is not advisable, because the delicate, subtle colors of the natives will be overpowered.

Wetlands

Owning freshwater wetland can be both a joy and a responsibility. The marsh is one of the richest animal habitats, and the purifying role that wetlands play in the groundwater cycle is important to all.

The maintenance of an existing marsh or the construction of a new wetland area normally requires prevention of compaction or filling, replanting with native species such as wild rice, arrowhead, rushes, and cattails, and the removal of invasive nonnatives such as phragmites (common reed) or polygonum (Japanese knotweed). Seed and plants of the native species and directions for planting are available from several commercial sources.

It is now national policy to prevent loss of wetlands because they are of enormous value in the overall environmental health of the country.

Traditional Landscapes

The maintenance of ornamentals, lawns, perennial and annual flowers, plant beds, and vegetable gardens has been the subject of numerous available books and bulletins.

The references at the end of this book list several publications that should be of interest to the reader.

Because this book deals primarily with the landscape design process, maintenance has been dealt with only briefly.

The discussion of maintenance techniques presented in this chapter is limited because the requirements of each region are unique. It is intended to provide only basic concepts and a general approach.

The importance of maintenance as a major element in the design process, however, cannot be overemphasized. Ongoing human care combined with natural growth can produce a memorable landscape of great beauty, comfort, and lasting value.
Livable Landscape Design focuses on the principles and process through which your home landscape can be designed to accommodate your particular lifestyle and simultaneously be sensitive to the natural environment in which your property is situated. These objectives can be accomplished by understanding and interpreting the naturally occurring landscape in the area and on your property; by recognizing potential environmental damage and how the landscape can be protected and enriched; by considering the natural factors of landform, soils, plants, water, climate, microclimate, and wildlife; by following the holistic process of landscape development through the stages of design, protection, construction, planting, and continued maintenance; and by using the design principles, methods, and vocabulary of materials graphically described in this publication.

It is hoped that Livable Landscape Design will encourage homeowners, landscape designers, and landscape nurserymen to take a fresh look at the approaches to landscape design with which they have become familiar and that ultimately the landscapes which we produce and live in will be simultaneously beautiful, functional, and environmentally responsible.
For Further Reference
Consult these Cornell Cooperative Extension Bulletins

**Annual Flowers for New York State** 141-IB-93
Your guide to serious planning of flower beds and borders. Lists botanical and common names, height, color, recommended uses, other handy information.

**Container Culture of Trees and Shrubs for Gardens and Terraces** 141-IB-173
Using containers can overcome soil problems, allow changes in landscaping, and use of less winter-hardy materials. A how-to section on selection, care, and feeding.

**Cornell Home Garden Guide for Ornamental Trees and Shrubs** 141-S-112
An easy-to-follow pamphlet on successful care for deciduous and evergreen shrubs and trees.

**Gardening with Herbs** 141-IB-123
Description, culture, and uses of more than 50 herbal plants. Fully illustrated, references, sources.

**The Home Fruit Planting** 155-IB-156

**Home Lawns** 141-IB-185
How to have the best lawn on your block. New lawns, maintenance, pests, solving specific problems, references, illustrated. Updated revision of a longtime favorite.

**Home Lawns: Varieties and Pest Control Guide** 141-IB-190
Specific recommendations for selection of grass species and pest control. A supplement to Home Lawns.

**Home Vegetable Garden** 161-IB-101
A popular how-to-do-it reference. Planting schedules, recommended varieties, pest control, and much more.

**Illustrated Guide to Pruning Ornamental Trees and Shrubs on the Home Grounds** 141-IB-23
A how-what-when guide to proper pruning; includes hedges.

**1987–88 Guide to Safe Pest Management around the Home** 139-S-74
Handbook for pest identification and control.

**Ornamental Grasses for the Home and Garden** 141-IB-64
Describes many grasses that can be used as ground covers near ponds, swimming pools, in perennial borders or rock gardens. Gives cultural information.

**Planting and Maintaining Trees and Shrubs** 141-IB-24
Includes information on trimming, site and soil considerations planting, time, maintenance practices.

**Rock Gardens** 141-IB-159
Basic handbook on site selection and preparation, design, construction, sources of plants. Full-color plates of 50 rock garden plants, with descriptions and comments for use.

**Salt Injury to Roadside Plants** 153-IB-169
Diagnosis, prevention.

**Sequence of Bloom of Perennials, Biennials, and Bulbs** 141-IB-196
Nearly 300 species listed to show colors, period of bloom, and plant height. Essential to ordering materials and planning gardens for maximum beauty.

**Shrubs for Landscape Plantings in New York State** 141-IB-50
Describes and gives cultural information on low, small, medium, and large shrubs.