Utah State University EXTENSION

Water-wise Landscaping

guide for water manage-ment planning

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EC 458
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C over Photo

Water-wise Landscaping by Curt Maughan and Melody Fasselin

Preface

Figure 1 (far right). Water-wise landscaping with a native plant border and turf.

Land use, like a pendulum, has swung from sparse land settlements of Native Americans, with a reverence for nature, to sprawling developments of western settlers. The settlers' intent was to "tame" the harsh western elements. The result was the introduction of soggy green English landscapes to the West.

The landscape approach across the country has been to clear the land and "start over," rather than to make use of existing indigenous plants. A concept is now emerging that integrates some reverence for nature and recognition of the aesthetic value of the local landscape with fulfillment of contemporary human desires. Once a landowner has learned about the local climate, soils, plants, and animals, and has identified intended uses for a landscape, alterations can be made to specific areas of land to create a useful, water conserving landscape.

Water-wise landscaping is an approach to landscaping that focuses on water conservation, designs that address human desires, and use of drought tolerant native or introduced plants. Emphasis is placed on planning for the user and for the environment. There isn't a more interesting landscape than a well designed native plant landscape that provides diversity, beauty, and habitat for indigenous wildlife (Figure 1). In northern Utah valleys with only 14↑ of annual rainfall, such landsccaping is important for conservation of water and preservation of the scenic aesthetic quality of the region.

This book was written primarily for residents of northern Utah with an interest in landscaping to conserve water. The basic concepts of landscape design apply anywhere, but the plants and the cultural practices are refined for water conservation in this region (Figure 2). The region is within *plant hardiness zones* 4 and 5, referred

to here as *areas* 4 and 5 to avoid confusion with *water zones*. These hardiness zones / areas were established by the U.S. Department of Agriculture based on minimum annual survival temperatures for plants.

Plants rated for hardiness area 4 are capable of surviving -20° to -30°F, and for hardiness area 5: -10° to -20°F. Variations in microclimate make any classification questionable, but this is a useful guide.

Other factors that will determine a plant's hardiness for a region are wind exposure, snow cover, reflected light and heat from surrounding buildings, maximum temperatures, aspect (north, south, east, west), humidity, soil pH (acidity), and rainfall. Consult the local Extension agent if you are unsure of the hardiness number for your area.

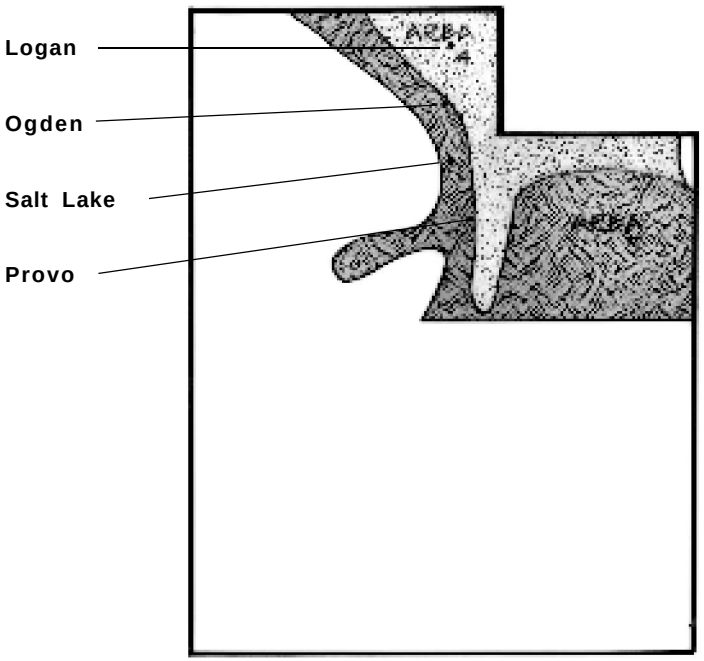

Figure 2 (far left). USDA Hardiness Zone Map, Areas 4 and 5.

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Special thanks to the following people for helpful reviews and comments: Craig Johnson, Advisor and Editor, USU LAEP Department; Larry Wegkamp, USU Extension Community Development Specialist; Larry Rupp, USU Extension Ornamental Horticulture Specialist. Also, many thanks to the following:

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Introduction

Envision a beautiful place near your home where there is native vegetation: grasses, sagebrush, oaks, and junipers or spruce, pine, and grasses. With an image in mind, place your house in the picture without disturbing the site. The view from inside your home is a natural garden. Occasionally you see deer and butterflies, and bird songs fill the air. Your water bill is reduced, there is little or no lawn mowing, and less fertilizing and maintenance. This is what Water-wise landscaping can be (Figure 3). It can be a contemporary landscape, a modification of a traditional style, or a combination of styles - the commonality is low water use.

Figure 3 (far right). Natural landscape with wildflowers, grass and spruce.

Figure 4 (right). Traditional landscape that is predominantly bluegrass.

DEFINITION

Water-wise landscaping is landscaping without wasting water. It includes planning a yard for your lifestyle, grouping plants together with similar water requirements, watering just to meet plant needs and using non-water consuming areas, such as decks and patios.

By using water wisely up to 50% of landscape irrigation water can be saved. Consider a typical quarter acre lot with a 7000 square foot traditionally landscaped yard planted to Kentucky bluegrass and common high water use ornamental trees and shrubs (Figure 4). The irrigation water requirement for these

plants for 5 months, at 18 gallons per square foot (high water use), is 126,000 gallons.

Conversion of the landscape to low water use plants with an irrigation requirement of only 3 gallons per sq. ft. results in use of 21,000 gallons of water in 5 months. For many homeowners it would be preferable to plant one third of the yard with high water use plants at 18 gallons per sq. ft., one third with moderate water use plants at 10 gallons per sq.ft., one sixth with low water use plants at 3 gallons per sq.ft., and to install one sixth in a hard surface such as a wood deck, or brick patio, and walkway. This scenario would result in the use of 69,000 gallons of water for the season (saving 57,000 gallons). The water saving would be 45% of the total for the conventional landscape (Figure 5).

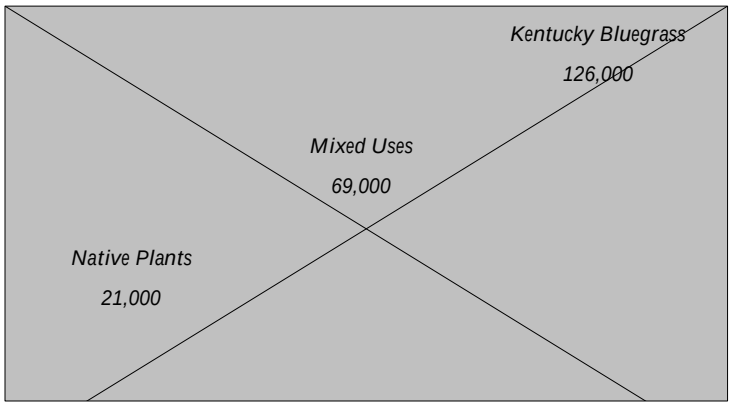


Figure 5 (far left). Comparative landscape water use (in gallons/ 1000 ft²/year) for native plants, mixed uses and Kentucky Bluegrass.

Water in Utah is cheap compared to other states. Using a current water rate of $1.00 per 1,000 gallons of water plus $1.00 per additional 1,000 gallons, only $57.00 per season would be saved in the example above. But, as the population and water demands increase, and water supplies decrease, both rates and potential savings will increase.

SOCIAL BENEFITS

The cumulative benefit of saving 57,000 gallons of landscape water per house per year, equates to a greater saving than the immediate monetary reward. It would slow the rate of environmental degradation by decreasing the demand for water and by curtailing the immediate need for additional water impoundments resulting in savings of billions of tax dollars for water development projects. It would also protect the natural scenery, fisheries and wildlife habitat.

THE CONSERVATION ALTERNATIVE

Maintaining a lush green landscape in Utah requires considerable time, water, fertilizer, and pesticides. Consider the alternatives:

1. Create a native low water use landscape with shrub beds, small perennial gardens and patios.
2. Compromise and retain small high water use areas, such as turf, and convert the remaining yard to patios, decks, walkways, and low water use plants.
3. Convert small areas of an existing landscape each year to lower water consuming plants.

Costs of converting to a water conserving landscape are higher than the initial financial saving on water. However these costs equalize in time, and the day is fast approaching when there will not be enough water or enough affordable water to waste on lush landscapes. Now is the time to plan and install a water-wise landscape for a new home or to convert a high water use landscape for an existing home.

HOW TO USE THIS BOOK

This guide will take you through the steps necessary to plan, design and establish a water efficient landscape.

Getting Started

The first section explains how to develop a map of the yard. This includes locating existing buildings and environmental features such as: vegetation, direction of prevailing wind, slopes, direction of drainage, soils, sunny / shaded areas, and unique aspects of the site. The next step is to find ideas by walking in open spaces with native vegetation to observe plant communities; walking through neighborhoods; and looking at garden and landscape books and magazines.

Planning

Planning involves identifying people's preferences, intended uses and goals for the landscape. These goals are then combined with the environmental features of the property to create a map. This "synthesis map" is refined by applying design principles to create a beautiful, functional landscape.

Designing

Design principles include balance, emphasis, unity / variety and continuity. Two additional design considerations are presented that are important to the success of your landscape: water zoning (grouping plants by water requirements), and climate control (planting to maximize winter solar gain and summer cooling).

Plant Selection

Allowing time for careful plant selection will be important to the success of your landscape. Tables of hardy plants for this region are listed by plant type: trees, shrubs, annuals and perennials, ground covers, and turf. The tables are arranged in water zones reflecting weekly or monthly plant water requirements.

Implementing Your Plan

Implementing your plan may involve site grading, creating positive drainage, preparing and amending soil, planning / installing an irrigation system, constructing hard surfaces, planting, mulching, and maintenance.

Bibliography

The references listed within each section to provide additional information are summarized in the bibliography.

Getting Started

DRAWING A PLOT PLAN

A plot plan is a map of a house and yard showing the existing buildings, property lines and utilities. If a plot plan of the property exists, you have a head start. If you need to make a plot plan, read this entire section before starting. Property dimension lines should be available from your city engineering department.

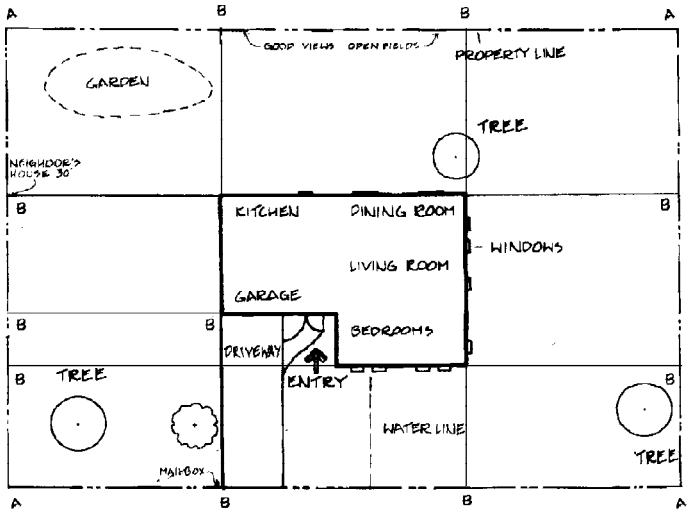


Figure 6 (right). Sample residential plot plan.

Materials Needed to Prepare a Plot Plan

- 100′ measuring tape
- masking or drafting tape
- clipboard
- ruler or engineer's scale
- pencil and eraser
- 8-1/2↑ x 11↑ graph tracing paper with 4 or 10 squares per inch, giving you a scale of 1↑= 40′ or 1↑= 10′
- right angle triangle
- T-square
- french curve
- circle template

Note: foot = ′ and inches = ↑

Begin by taking a quick walk around the yard and notice the location of the house, other structures, trees, property lines, etc. Gather a clipboard and pencil, 8-1/2↑ x 11↑ graph paper, a 100′ measuring tape and a helper.

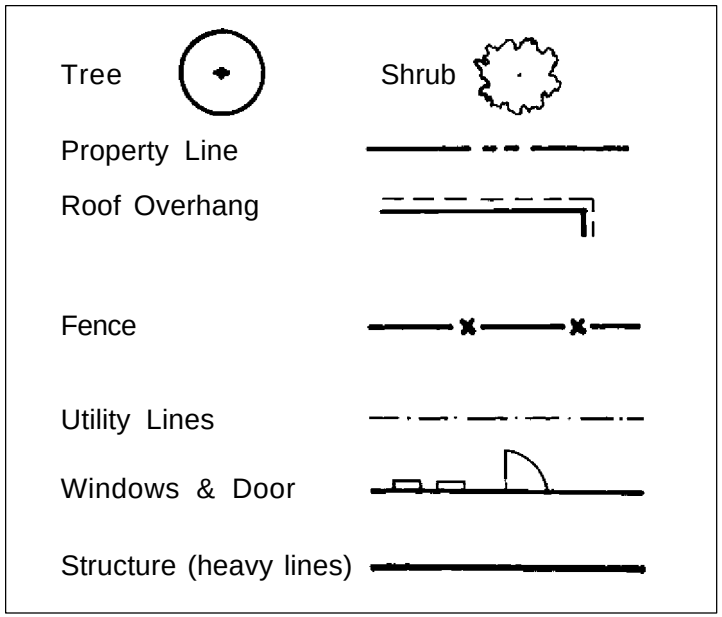


Table 1 (far left). Quick symbols.

Measure the length and width of the property between the property corners (Fig. 6, A-A′).

Measure from the property lines to the house corners sighting along the sides of the house (Fig. 6, B-B′).

Next, **locate**, measure and draw other structures, utility lines, driveways, garbage storage areas, existing gardens, existing trees, easements and setbacks. Approximate the location of adjacent houses or anything that would influence your views or solar access.

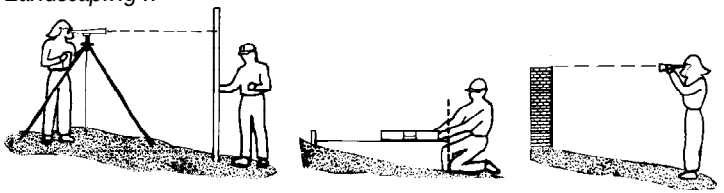
Consult the city or county planning department about landscaping ordinances. There are setback limitations and height restrictions that apply to landscaping.

If the lot has more than a gentle slope, you will need to determine the grade or change in elevation across the property. This is done by using a carpenter's level, a hand level, a surveyor's level and rod, or by hiring a surveyor (Figure 7). If you have steep erosive slopes of 50% or more (50′ elevation change in 100′), you may save money by hiring a landscape architect to assist you with a plan to stabilize the slopes.

Make a clean bold copy of your plot plan that can be easily read through tracing paper, orient the lot so north is at the top of the page. You will need this for the next steps.

References

Western Home Landscaping, All About Landscaping, and Residential Landscaping I.



Surveyor's level *Carpenter's level* *Hand level*

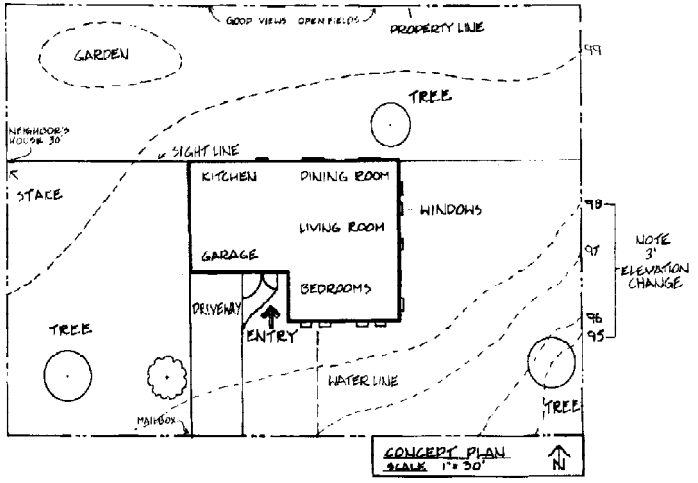


Figure 7 (left and left below). Levels used for determining the slope of the site, and the resulting slope map with lines showing approximate grade changes.

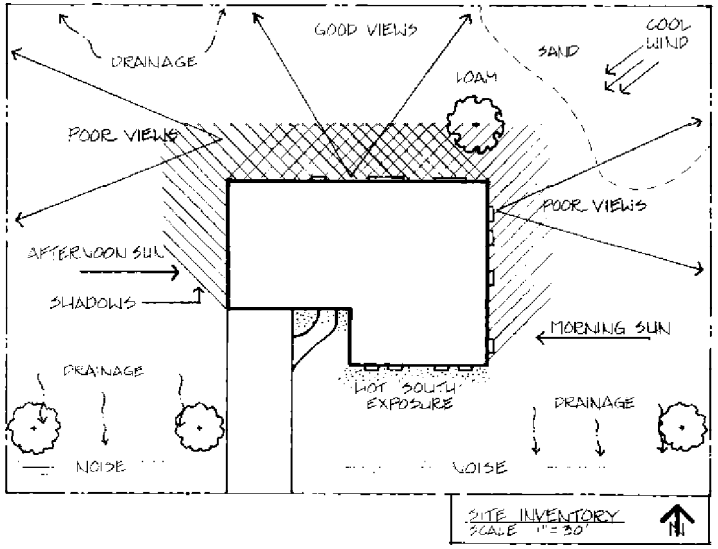
Figure 8 (far right). A site inventory of environmental factors, utility lines, buildings, and plants.

SITE INVENTORY

Inventorying your site is easy and important to the success of the final plan. The objective is to note site assets and constraints for planning (Figure 8). Trace your plot plan on an 8 1 / 2↑ x 11↑ sheet of tracing paper.

On the copy, draw the following:

- existing vegetation
- arrows showing the direction of prevailing winds
- a symbol indicating noise sources
- steep slopes
- drainage direction
- location of different soils, refer to "Soils" below
- areas of good / poor views
- sunny areas and areas of dense shade
- wetlands, rock outcrops or other unique aspects of the site



Reference

Landscaping.

SOILS

It is important to learn about soils before planning a landscape or selecting plants. Soils in northern Utah areas 4 and 5, vary from porous excessively drained sandy soil to heavy poorly drained silty clay loams. The soil acidity varies too, but is usually about pH 7.5-8 (ranging from pH 6 to pH 10). This is alkaline on the pH scale of 1 to 14, where 1 is acidic, 7 is neutral and 14 is alkaline. Fortunately, some plants thrive in these alkaline soils while others must live in acidic soils.

A **soil test** will provide specific information about your soil which will help you select plants that are tolerant of your soil. Soil testing is easy to do. Simply call for a soil test kit at 797-2217, or write to **Soil Testing Lab, Utah State University, Logan, UT 84322-4820**. The soil test kit comes with instructions. It is important to take soil samples in areas where you may plant and where there are soil texture changes as discussed below. Mark the sample site with a numbered stake and note it on your site inventory map. The results of the soil test will indicate the pH and high and low levels of soil nutrients for plant growth. Specify your intended use, such as Kentucky bluegrass turf or water conserving grasses and native plants with no irrigation. The lab will adjust nutrient recommendations accordingly. With this information, you can amend your soil by adding the correct amount of nutrients.

Characteristics

Soil texture and structure effect soil drainage and plant survival. Coarse textured soils with little structure, such as sands, drain and dry out rapidly. Fine soils with developed structure such as clays drain more slowly, thus holding water longer.

Alkali, or sodium salts, destroy soil structure. If you have a clay soil with alkali, your plant selection will be limited because few plants can tolerate the lack of air space, waterlogged soil and high sodium salts. It is advisable to find plants that tolerate these conditions, rather than try to amend such a difficult soil.

Some soils have an impervious hardpan or fragipan layer within good soil. If the layer is thin, it can be broken up to allow roots to extend below. When the layer cannot be broken, or if you have shallow soil (less than 3′) over rock, either build raised planting beds or grow shallow rooted plants such as perennials, annuals or ground covers.

Mapping Your Soils

The USDA Soil Conservation Service has mapped the soils in this region. Published soil surveys are available from local offices and usually at the local library. The mapping is done at a large scale so you will find good general information about the soils in the vicinity, but you will need to "map" your own soils in more detail.

With a shovel and a bottle of water, walk to different sections of the yard and make a soil test in each section. This is done by digging out a handful of soil within 12↑ of the surface and adding a few drops of water to it. Roll the soil into a ball if possible and squeeze it between your index finger and your thumb. If it crumbles, feels very coarse, and your hands are rather clean, it is likely a sandy soil. If your hands are muddy, the soil feels sticky but still coarse, and the soil makes a crumbly ball; it is probably a loamy soil. If the soil is very sticky and you are able to make a smooth ball that ribbons when you squeeze it, it is likely clay.

It is common to have sandy loams, clay loams, or loamy clays, but it is most important for irrigation and drainage to classify soil into one of three categories: sand, loam or clay. Once you have an idea about what texture the soils are, draw lines on your site inventory map to delineate the soils and label them sand, loam, or clay. You can confirm your soil classifications by requesting texture determinations when the soil test samples are sent to the lab. Be sure that samples are numbered and shown on your inventory map.

Reference

Water-wise Gardening.

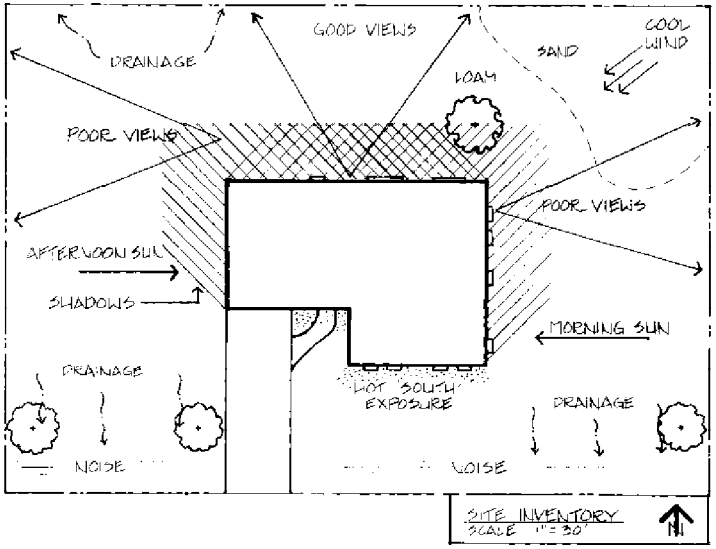
SITE ANALYSIS

Now put a sheet of tracing paper over the site inventory map. Analyze the site and conceptualize solutions to the limitations shown on your map (Figure 9).

Indicate screens to hide poor views and show buffers to cold winds. Consider and note soil limitations and hazards from steep slopes.

Next, evaluate the neighborhood landscape. Is there an element worth repeating such as a street tree planting that unifies the appearance of the neighborhood? Note and plan to emphasize assets of your site such as well drained soils or good views. Analyze and indicate on the map, the climate control potential for shading the south and west sides of the house during summer to save energy and for comfort.

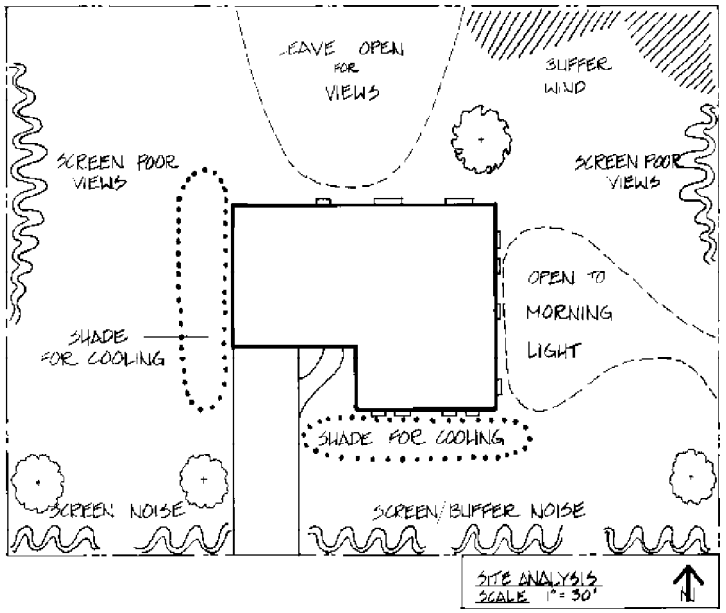
Figure 9a (right). A site inventory for comparison with site analysis.



Reference

Nature's Design.

Figure 9b (far right) Site analysis.



LANDSCAPE IDEAS

Landscape ideas come from experiences; landscapes we see and enjoy; books about art, landscape and environment; neighbors yards that we like or dislike; walks in the foothills and mountains; and other sources.

Look

Before planning your yard, look at what others have done. Walk or ride a bike in different neighborhoods looking for new ideas. Many homeowners in the Salt Lake area are converting small areas to more water conserving plants (Figure 11). Use their successful ideas in planning. Walk the foothills and notice which plants are growing together. Think of their use in your landscape.

Visit

There are many sites worth visiting including the Utah Botanical Gardens in Ogden and Kaysville, and the Red Butte Gardens and Arboretum in Salt Lake City (Figure 10). They have a diversity of native and introduced plants. Red Butte Gardens also offers classes in residential landscaping. Although it is out of the region, the Denver Botanic Gardens, Denver, Colorado, has beautiful low water use gardens.

Figure 10 (far left). Red Butte Garden and Arboretum, Salt Lake City, Utah.

There are several landscape architecture, horticulture and gardening magazines with pictures helpful for visualizing what you want to achieve.

Relating Ideas to Your Site

Create a landscape that fulfills the needs of your family, and responds to the assets and constraints of the site. Ideas gathered from looking, visiting and reading should be adapted to these needs with sensitivity to your site, to the land and to the growing conditions. Watching your landscape for a year and just maintaining what exists is educational. It allows time to learn about the property, recognize microclimates critical to plant growth, note seasonal changes, identify existing plants, and observe wildlife use of the site.

Read

Sunset Magazine has published *Water-wise Gardening,* a helpful book with good water-wise information, although, the plant section is directed to California. *The Small Garden* by John Brookes has good ideas on incorporating hard surfaces such as brick or stone into the landscape. *Backyard Design* by Breskend provides ideas on the use of decks and fencing as well as garden designs.

The Utah Native Plant Society prints a newsletter called "Sego Lily" with good information about native plants. Society members are using water zoning in areas and they are friendly and willing to exchange plant information.

Figure 11 (left). A water conserving landscape in Salt Lake City, Utah.

Planning

The planning objective is to evaluate your needs for the landscape and site and develop goals that can be accomplished through design and installation. Synthesizing environmental considerations with your program of activities and goals will lead you to a design concept, a theme, for your design. Without planning, landscapes often become a hodgepodge of plants and disorganized spaces that are neither used nor enjoyed.

THREE IMPORTANT PLANNING CONSIDERATIONS

1. Landscape Use

Consideration must be given to the arrangement of landscape activity areas and the compatibility of adjacent uses. For example, it may be preferable to locate an outdoor eating area near the kitchen door for convenience. A secluded patio may be planned near an exterior bedroom door but it would not be advisable to locate it adjacent to a volleyball court. If street noise and unpleasant views must be contended with, use of aesthetic barriers should be considered to diminish annoyances.

2. Circulation

Circulation routes facilitate use of the landscape. Wide paths or large connecting spaces enable use by many people simultaneously. Narrow winding paths with uneven stone surfaces discourage active use, and help seclude areas. Paths or walkways and other connecting spaces should be shown in the conceptual phase and the final design.

3. Environmental Aspects

Planning to make the best use of site assets and limitations is important. Assets may include views, rock outcroppings, well drained soils, areas with sunlight or shade, or existing vegetation. Microclimate (a unique climate in a small area) is easily overlooked, but it is important for comfort and plant survival. Utilizing summer shade and breezes, and the warmth of the winter sun, with protection from cold wind will enhance your enjoyment of the landscape.

Site limitations may exclude some landscape uses but facilitate others. Limitations could include: a high water table, an odd shaped lot, poor drainage, high wind exposure, steep slopes,

highway frontage, or flooding. For example, a narrow lot may preclude use for volleyball but it may facilitate development of a secluded patio or a wildlife area. Addressing limitations early in the planning process is important.

FOUR BASIC PLANNING STEPS

There are four basic steps in the planning process: program development, conceptual planning, synthesis, and design.

1. Program Development

Program development is a process for determining who will use the landscape and for what purposes. The outcome will be a list of goals and desirable activities to accomplish in the landscape. The integrated use of the interior spaces in the home and the exterior spaces of the landscape becomes an important consideration in this stage of planning. Thought should also be given to who will install and maintain the landscape, and at what cost.

2. Conceptual Planning

This is a process of delineating spaces in the landscape for program activities and goals. The resulting plan drawing will include a hierarchy of spaces from large dominant spaces to smaller spaces sized for intended uses.

3. Synthesis

In this step a synthesis drawing is developed by combining the drawings you have made to this point: site inventory, site analysis, and conceptual plan. The synthesis drawing illustrates how the conceptual plan fits with the limitations and assets of the site. Adjustments can then be made to the conceptual plan before developing a final design.

4. Design

Design is a process of using your imagination to create and refine forms and spaces to achieve aesthetic and activity goals. Inherent in this is the organization of your thoughts about use of space for specific purposes. Design emphasizes the aesthetic quality of the landscape yet accommodates your program goals in an environmentally sensitive way. Because of the importance and complexity of the design process, it is treated as a separate section following this one.

PROGRAM DEVELOPMENT

Program development is used to identify your priorities for the landscape and to establish goals for accomplishment. These goals may include a shaded yard with large trees, low ground covers, and a large stone patio for reading and entertaining. Your goals might include an active area for badminton or a natural area for wildlife.

The following are planning ideas to consider for your yard. Add to the list, try to bring up concepts you or your family haven't considered before.

Think of your landscape as an extension of your home. Envision one of your rooms extending outside, creating an exterior space. Think of the beauty created by the connection of the interior / exterior expanse as well as the functional possibilities of the connection. Apply this thinking to different rooms of the house and to the activity areas specified for outdoor use. Then develop and prioritize a list of landscape elements for your family and create goals.

Private/Secluded Areas

Continuation of private areas from the home to the yard may be useful to you, or you may desire an outdoor hideaway that is separate and secluded from the house. Consider these options and the aesthetic implications of their location in your yard.

- Do you enjoy sitting / reading / sunbathing in the yard?
- Do you need quiet and active areas that can be used simultaneously?
- How about a hot tub under the stars?

Active Areas

Locate active areas adjacent to other compatible use areas or resolve the issue of how to separate the spaces successfully.

- Are active use areas important such as:
  basketball, badminton, horseshoes, swings, softball, frisbee
- Should a children's play area be visible to a certain room in the house?

Wildlife Areas

These are often perimeter areas that can be planned to attract wildlife to your property. Adjacent land uses should be chosen and planned carefully so that wildlife are not frightened away, and to avoid feeding damage from wildlife.

- Is attracting birds and other wildlife an objective? Consider: birdbaths, feeders, viewing areas, food / native plants, and protecting the remainder of the landscape from browsing.

Entertaining

Consider the convenience of locating outdoor entertaining areas near a kitchen or dining room, plan the size of the area based on the size of the anticipated user group. Think about enclosed areas with trellises and overhead structure versus open areas.

- Do you entertain outdoors creating the need for: sitting areas, storage for chairs, barbecue pit / cooker, paths to connect areas, or privacy / public space?
- Do you want an east facing outdoor breakfast nook, or an evening shaded deck?
- Would you enjoy having lunch in a sunny / shaded area of the yard?
- Is night lighting important in your landscape?

Water Features

These are usually used as a focus element in the landscape. They may also be installed for functional uses.

- Are water features important such as: fountains, swimming pools, birdbaths, a hose and wash basin for garden vegetables, or a lily pond?

Consider locations for outdoor faucets.

Gardening

If gardening is a priority, consider the aesthetic incorporation of a garden into the landscape, as opposed to isolating and screening it. Consider use of the garden and its maintenance.

- Do you want a vegetable garden and an area for tool storage?
- Do you want a cutting or formal flower garden?
- Is a native plants garden of interest?
- Would you enjoy creating an alpine garden and being involved with an international alpine garden club?
- Will there be a compost pile?

Maintenance

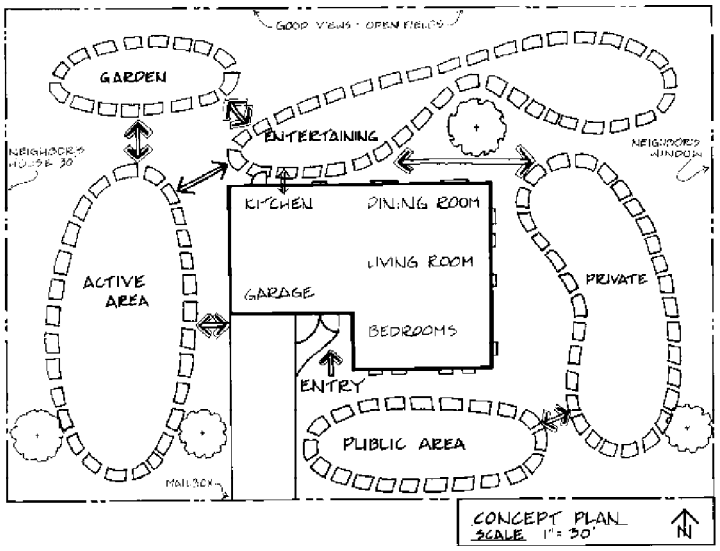
Determine the amount of time you are willing to devote to landscape maintenance. Consider storage of necessary tools and landscape equipment.

- Is low maintenance a priority? Consider using vegetative ground covers, hard surfaces, native plants, low water use plants, and mulch.
- Do you enjoy high maintenance tasks such as frequent mowing, fertilizing, watering, pruning, and weeding?
- Is snow removal necessary? If so where can snow be piled without damaging plants?

General Use

Everyday uses of the landscape are important considerations. Try to facilitate these uses in an aesthetic manner.

- Is a workshop or shed needed?
- Is a garage or carport needed?
- Do you use a clothesline?
- For parking, do you need a turn around, wide driveway, parking space; or do you want to minimize paved surface?



- Will you have a dog run or a fenced yard?
- Consider storage for garbage cans, recycling boxes, or fireplace wood.
- Will additions be made to the house resulting in the need for temporary landscaping?
- Do deliveries made to the house need to be accommodated (mail, milk, parcels)?
- Do you want more sun / shade in the yard / house?

Areas Viewed by the Public

You must often make a decision about whether to conform to the neighborhood landscape or to carefully and tastefully create your own style. Your intended use of this area will be a determining factor.

- What type of views do you hope to create from inside the house and at the entry to your house?
- What impression do you want to create in the public space?
- If you have a narrow curbside planting strip, can a low maintenance, low water use ground cover be used?
- Is there a streetscape theme worth repeating such as rows of trees?
- Will you use the public space?

After you have developed a list of intended uses for your landscape, set goals to design and install them.

These goals will be your checklist for the conceptual plan and your final design.

CONCEPTUAL PLANNING

Conceptual planning identifies compatible and incompatible locations of activity areas, pathways or connections to spaces,

Figure 12 (far left). A concept plan delineating areas for activities.

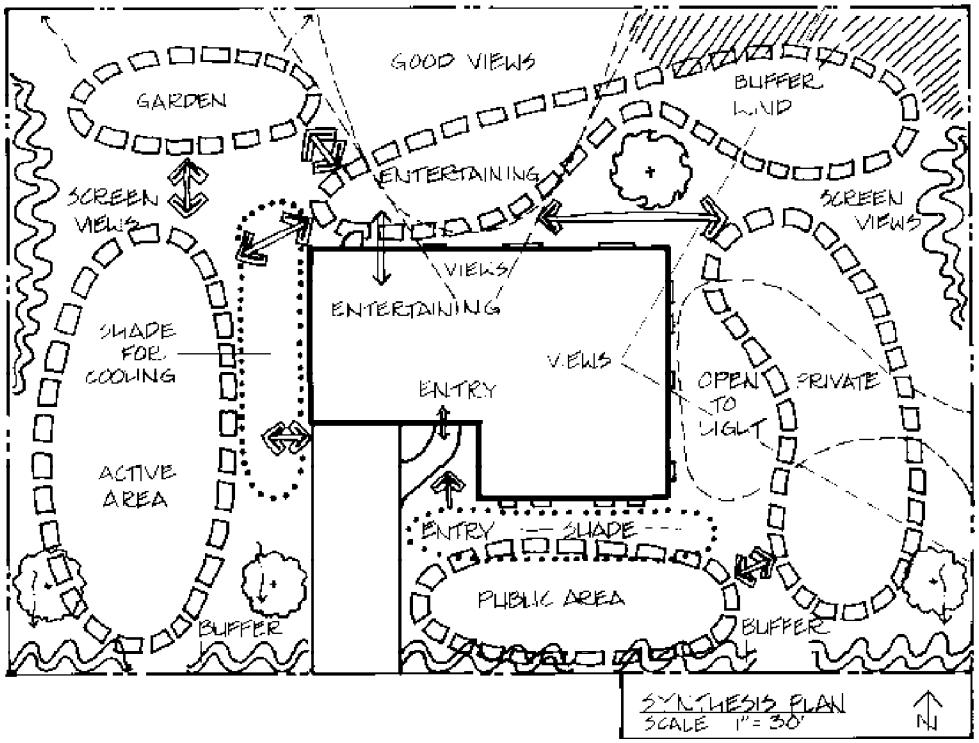


Figure 13 (right). A synthesis plan of the concept plan and site analysis.

and inside / outside connections for various uses. A concept plan shows your intended activities located in the landscape where you think they will be most appropriate.

On a clean plot plan of the yard and house, draw areas for the uses you identified in the program development process (Figure 12). Use loose free lines, erase and juggle locations until the uses fit the way you want them. You now have a concept plan.

SYNTHESIS

Now trace the concept plan and the site analysis on one sheet of paper (Figure 13). Check for incompatible uses such as a garden planned where a healthy tree exists or a sunlit patio planned within the shadow of the north side of the house. Adjust the concept plan until it works well with your site analysis. This will be the basis for your landscape design.

It is important to begin considering the aesthetics of the spaces being created. The entry, for example, is a key visual point for you and the public. The path to the front door should be safe and welcoming. While bluegrass has traditionally been used for front yards, more appropriate landscaping employs interesting combinations of low water use trees, shrubs, flowers and ground covers. This is more in keeping with the character of the west.

Active areas may require the use of turf for durability. This may be high, moderate or low water use turf, depending on the preferred look and the planned amount of water use.

Vegetable and flower cutting gardens are typically high water use areas incompatible with active use or wildlife areas. They work well adjacent to sites for passive recreation and entertaining, or as borders along walkways or around patios.

Water features are often used as a focal point in entertainment areas, and they are a welcome addition to a secluded area for relaxation.

General use areas need to be durable, attractive, and most people prefer that they be low maintenance. A low water use planting of flowering shrubs and ground cover can improve the

appearance of a storage shed. Tall plants can help screen garages, and natural wood fencing can be used to hide garbage containers. The small details in a landscape often give a finished quality look.

Phased landscaping is discussed in the installation section. If you are renovating an existing landscape or beginning with bare soil, the landscape can be developed in stages, or all at once, depending on your needs, budget and energy.

Useful references for planning include: *Step by Step Landscaping, Western Home Landscaping, Water-wise Gardening, How to Plan Your Own Landscape, Site Planning,* and *Landscaping.*

Designing

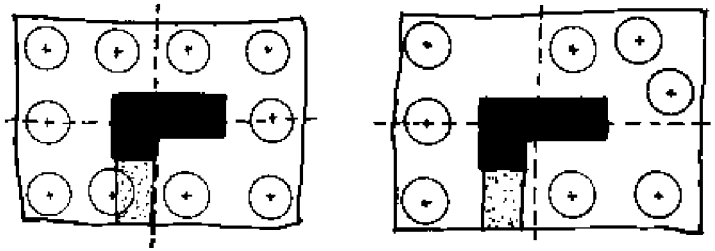
The objective of landscape design is to aesthetically define space to satisfy your program requirements in an environmentally responsible manner. The design should be tailored to fit your property.

DESIGN PRINCIPLES

Several guiding principles used in designing landscapes are: balance, emphasis, unity / variety, and continuity. A brief description of the use of these principles follows. For more information see the references on page 20.

Balance

There are two types of balance; symmetrical and asymmetrical.



Symmetrical tree planting *Asymmetrical tree planting*

Symmetrical balance uses identical distribution of items on each side of an area. It is more formal than asymmetrical balance. It can be achieved with a symmetrical distribution of trees, walkways or spaces on each side of a yard. It can also be created by symmetrical use of color, tree or pavement texture, and tree or structure shapes or volumes.

Asymmetrical balance is achieved by creating the same feeling of weight, or mass, on each side of a yard, but with random distribution of the elements mentioned above. The spaces created or implied are irregular and interesting. Asymmetrical balance is more conducive to diverse environmental characteristics such as undulating topography, natural plant materials, and changing soil conditions.

Seasonal color balance is fun to use in design. It is a process of determining when colors appear on plants in flower blooms or leaves, what the colors will be, and where to position them to achieve color balance throughout the year.

Emphasis

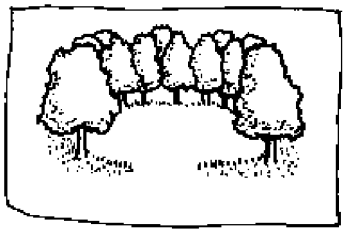
A focus created in the landscape is called emphasis. It draws attention and evokes curiosity, making the landscape interest-

Large tree, small shrubs

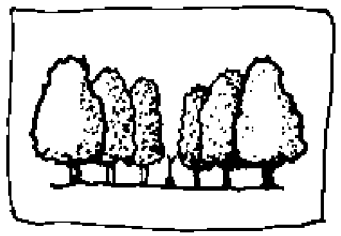
One red shrub with green shrubs

ing. It can be a planting theme, a fountain, a large space, or a structure. Contrasting colors, sizes and textures are used to create emphasis. A row of small shrubs planted on two sides of a large tree will help to emphasize the large tree. One red shrub planted among many green shrubs will become the focus, but it is possible that the mass planting of shrubs is the landscape emphasis. An absence of plants within a space defined by plants can also draw attention, possibly with the intent of using a sculpture or a rock as a focus. The plant and landscape materials used must be in scale with the site to be effective. Many new tree varieties available from nurseries are smaller and more aesthetically suitable to most residential sites.

A house is often the focal point or emphasis in a landscape. If attractive house lines can be repeated to unite the house with the landscape, you will find the design stronger and more pleasing. Some architecture is improved by screening with landscape plants such as tall trees and wide shrubs. Strong curves or angles on the ground plane can also be used to draw attention from the house.



Enclosure

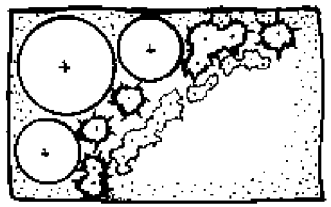


Emphasis

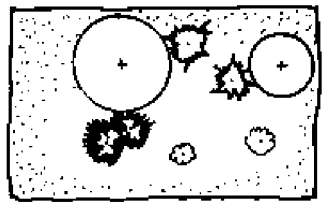
Vertical tree trunks and overhead tree canopies with low horizontal shrubs define areas and can enclose and emphasize spaces. Rows of trees can also provide strong emphasis as shown in the two sketches adapted from *Outdoor Design.*

Unity and variety

A design is held together by unity and variety. Unity is accomplished through repetition, such as group plantings of like plant materials versus a scattered planting of associated plants. The item repeated may be color, leaf texture, plants of a certain size or shape, spaces of a certain size, an arrangement of plants, paving materials, fencing, or details of the architecture. Forms of planting areas and hard surfaces such as patios are dominant unifying elements in a landscape.



Grouped planting with repetition of plant materials



Scattered planting with too much variety

Color is an important unifying element. Think of a mass planting of yellow gaillardia flowers in front of dark green shrubs in the backyard. As you look around the yard, visualize those colors along the sides of the yard too, and maybe in the front yard. You may repeat other colors as well such as red or shades of red or green; the repetition creates unity through continuity.

Variety assures that all landscape elements will not be the same. Use of a diversity of materials such as trees shrubs or paving surfaces adds interest. Variety of color use also adds interest, but use of too many colors can create a cluttered, busy, look.

Continuity

Continuity is the "thread" that is woven throughout the landscape. It includes repetition of plants, colors, textures, shapes, but it also emphasizes their use throughout. By repeating the use of the same texture in the landscape, you can create a sense of continuity. Consider a bed of junipers as a border in one corner of the yard, by planting additional small clusters of junipers in other areas, your eye will pick up the continuity or the familiarity in the landscape and it will feel comfortable. If you plant only junipers around the yard, the effect will be boring, there will not be enough variety for interest.

ADDITIONAL DESIGN CONSIDERATIONS

There are two additional design components of conservation design that are important to understand before you develop your final design: *water zoning* to conserve water, and designing for *interior climate control* for comfort and to save energy on heating and cooling.

Water Zoning

Water zoning is a design process that divides the landscape into areas that will receive a suggested frequency of irrigation. Plants with similar water requirements are then matched with the appropriate water zone. This makes it possible to more accurately meet plant water needs. Five water zones have been used in this booklet for discussion and classification of plant materials. There will be exceptions to the recommended watering frequencies as site and soil conditions vary, but the zones can be used as a guide.

The zones range from 0 to 4 as follows: no irrigation (zone 0), monthly irrigation (zone 1), irrigation every two weeks (zone 2), weekly irrigation (zone 3), and irrigation twice per week (zone 4).

Plants such as Kentucky bluegrass thrive on lots of water (30↑) per year plus rainfall (14↑), requiring irrigation twice per week (zone 4). Native plants in the valleys, such as sagebrush and rabbitbrush, survive with only 14↑ of rainfall per year and little or no irrigation (zone 0-1). It wastes water to irrigate plants that grow well without water, and many plants will die from too much watering.

Your decision about which water zone(s) to use in your landscape will be based on your environmental ethic concerning the amount of water to use for a landscape, how much you are willing to spend for landscape water, your design vision as it relates to the surrounding natural environment, and what you want to achieve aesthetically in your landscape. Compare the high (4) and moderate (2) water zones with the water conserving landscape design.

A landscape with a predominance of lower water zones, 0 to 1, will require less water than a landscape that is all water zone 4. Figure 14 illustrates the idea of water zoning by showing a typical Kentucky bluegrass landscape and a new water conserving landscape with a diversity of water zones.

A water conserving landscape often has more diversity of plants than a traditional landscape. There is also more diversity in water zones in this design that adds up to a substantial saving of water compared to a zone 4 landscape.

Interior Climate Control

A quick look at your site inventory map will show directions of cold winds, hot southern and western exposures, and areas with dense shade. Heat from southern and western exposures and cold winds from the north and northwest are the most costly environmental elements to contend with in terms of home energy use. You can protect the house from cold to some extent, by using foundation plantings as insulators, or by using trees and shrubs as windbreaks. Trees can reduce wind velocity on the leeward side, for a distance of 10 to 15 times their height. However, snow will often drift within the area from the trees to 10 times their height, on the leeward side. If you want to protect a north / northwest oriented entry or garage from north winds, use a dense staggered planting with several rows of evergreens and shrubs. The objective is to prevent wind and snow from blowing through to create drifts. If the lot is large enough, plant the windbreak a distance of 10-15 times the mature tree height from the house to avoid wind and snow drifts.

Winter sunlight and heat are valuable in this cold climate, so plantings should be carefully selected and located to allow sunlight to warm the house. While evergreens are good insulators, they also block light and heat, so they are often planted on the north side of buildings. Deciduous trees (trees that shed their leaves in the fall) are advantageous on the south, east and west sides of homes as they allow light and heat to reach the house during winter and provide shade during the summer.

Energy required for cooling can be significantly reduced by shading with trees, shrubs and overhead trellises. Because the angle of the sun is very high during summer, plants must be close to whatever they are to shade during midday. During the evening the sun drops to due west casting long shadows. Shading from the evening sun requires low dense screens. Refer to the charts in *Primer on Landscape Architectural Design with Plant Materials* for more specific information.

DESIGN EXAMPLES

Sample landscapes are presented in Figures 15 through 19, to provide ideas for water-wise designs.

As you look at the examples, think about the design principles discussed previously. Try to imagine yourself in the landscapes, think of the overhead tree canopy and the feeling of enclosure. Notice large and small spaces and their connection. Look for unity expressed in the shape of planting beds and hard surfaces. Determine if there is continuity within the yards and how it is achieved. Consider balance: with more formal symmetrical balance in some designs and natural asymmetrical balance in others. Look for repeated use of a shape that ties the design together. Identify elements that may be applicable to your yard.

REFERENCES

Nature's Design, The Small Garden Book, Water-wise Gardening, Landscape Planning for Energy Conservation, Southwestern Landscaping That Saves Energy and Water, Primer on Landscape Architectural Design with Plant Materials, and Guide to Residential Landscape Development volumes 1-3.

DESIGN MATERIALS

Landscape materials include hard surfaces such as concrete, brick, wood and stone, and soft surfaces such as sand, pea gravel and wood mulch. Landscape materials are selected for their durability, aesthetic qualities, cost, ease of installation, porosity for drainage, and maintenance qualities. They are a particularly

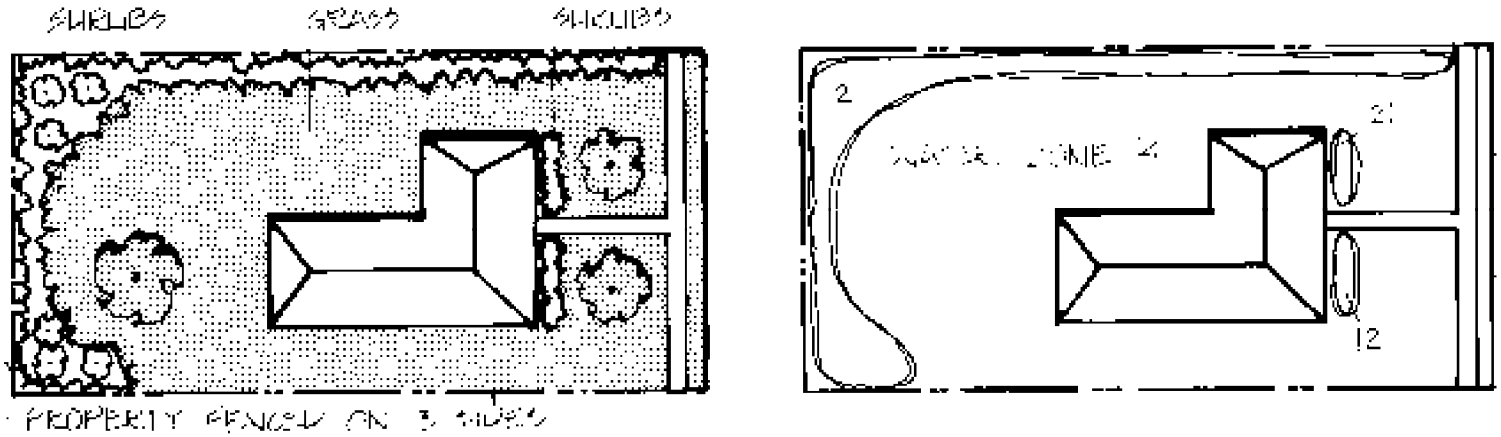


Figure 14a ***Before****. This is a standard landscape with Kentucky bluegrass, junipers around the perimeter and a few trees. Compare the high (4) and moderate (2) water zones with the water conserving landscape design below.*

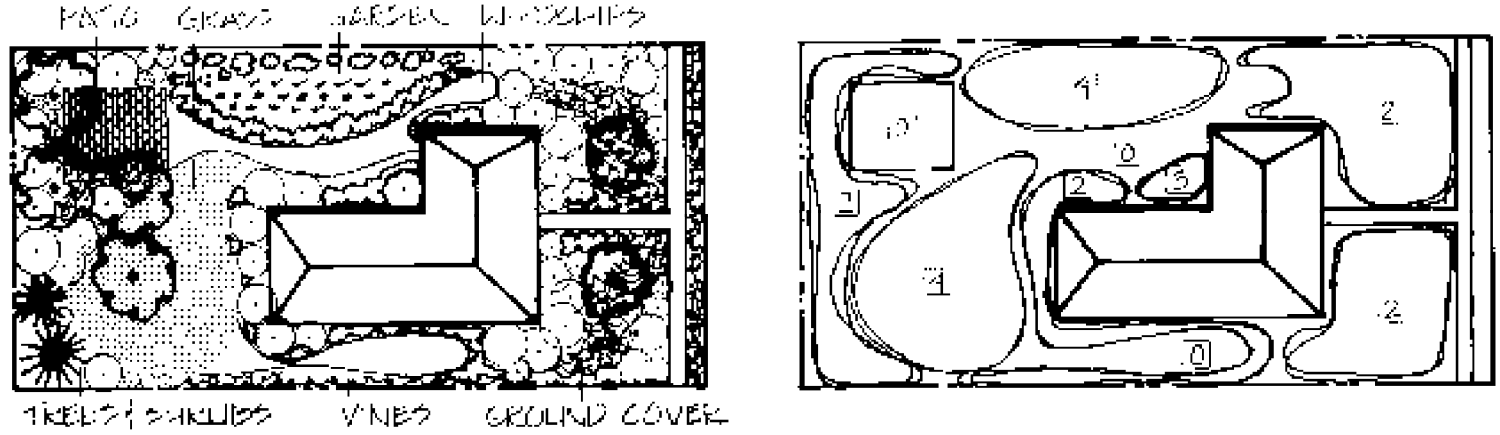


Figure 14b ***After****. A water conserving landscape often has more diversity of plants than a traditional landscape. There is also more diversity in water zones in this design that adds up to a substantial saving of water compared to a zone 4 landscape.*

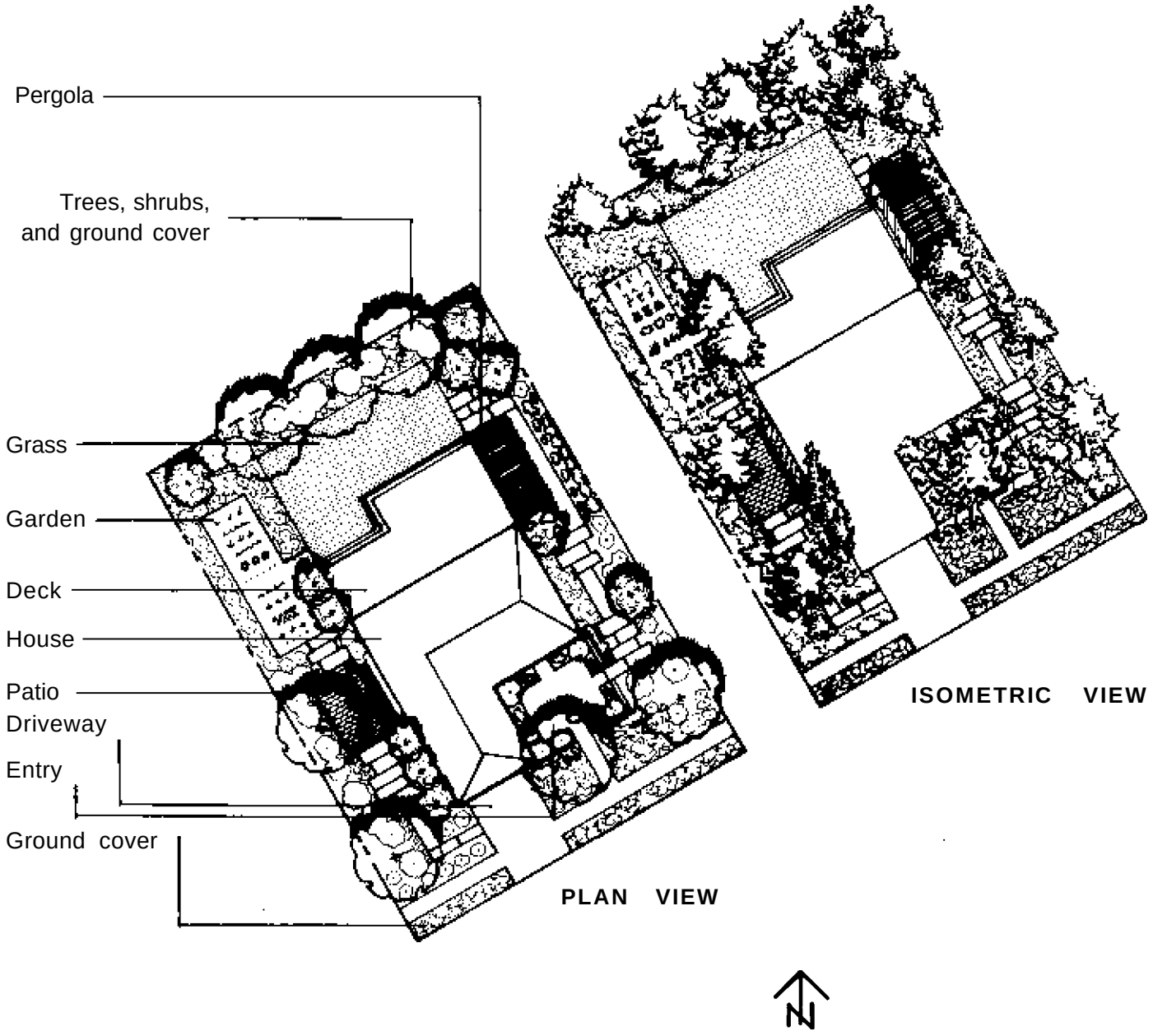


Figure 15. Rectangular modules can be used for space efficiency on small lots. The perimeter of this design could be low water zones 0 or 1. The grass and garden will require the most water. The entry should be a separate water zone.

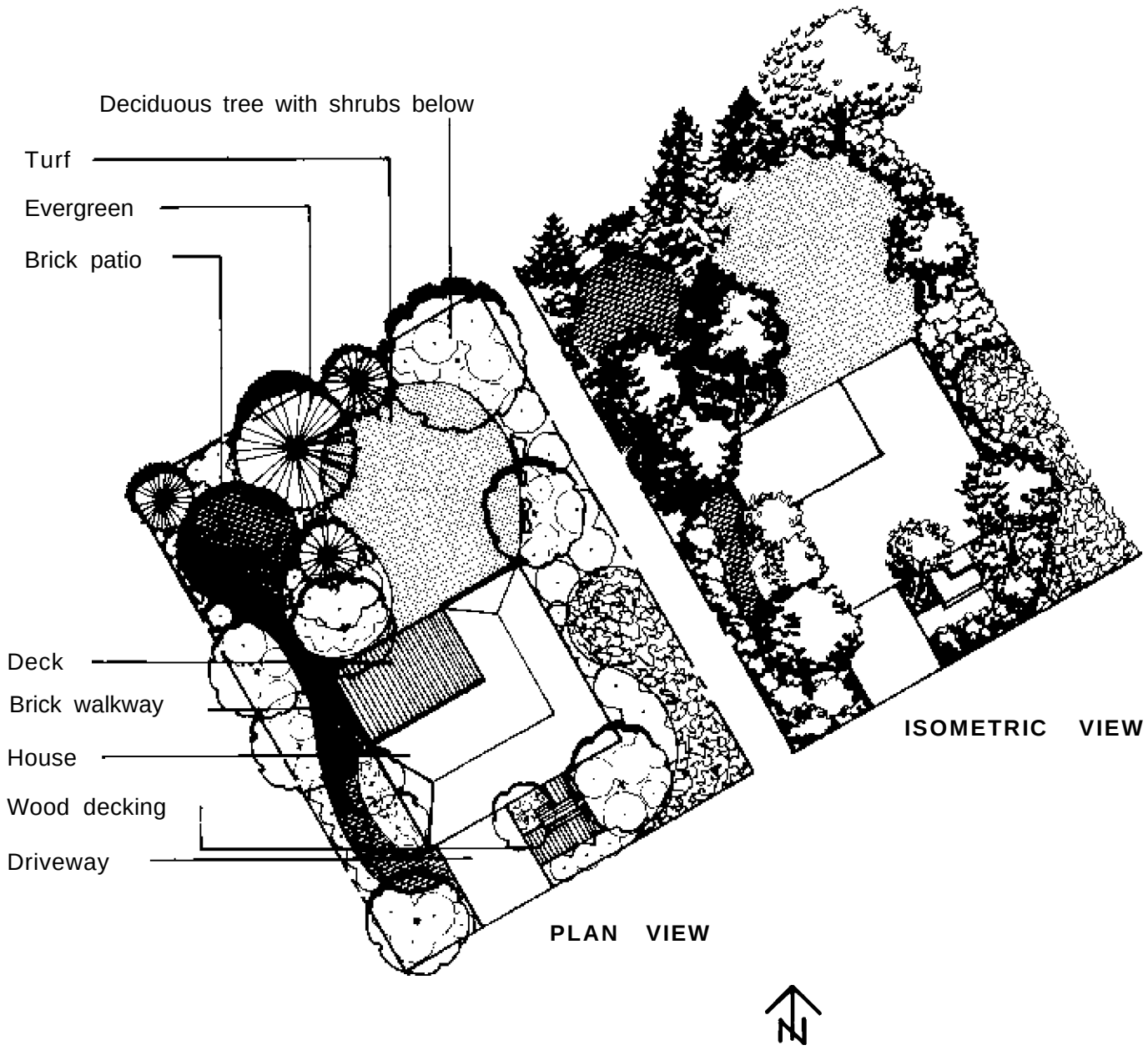


Figure 16. Curvilinear lines create a more natural appearance. Trees and shrubs are used to separate spaces, creating a large turf area and a private brick patio. Ground cover and drought tolerant trees and shrubs are used for the front yard and along the perimeter of the property.

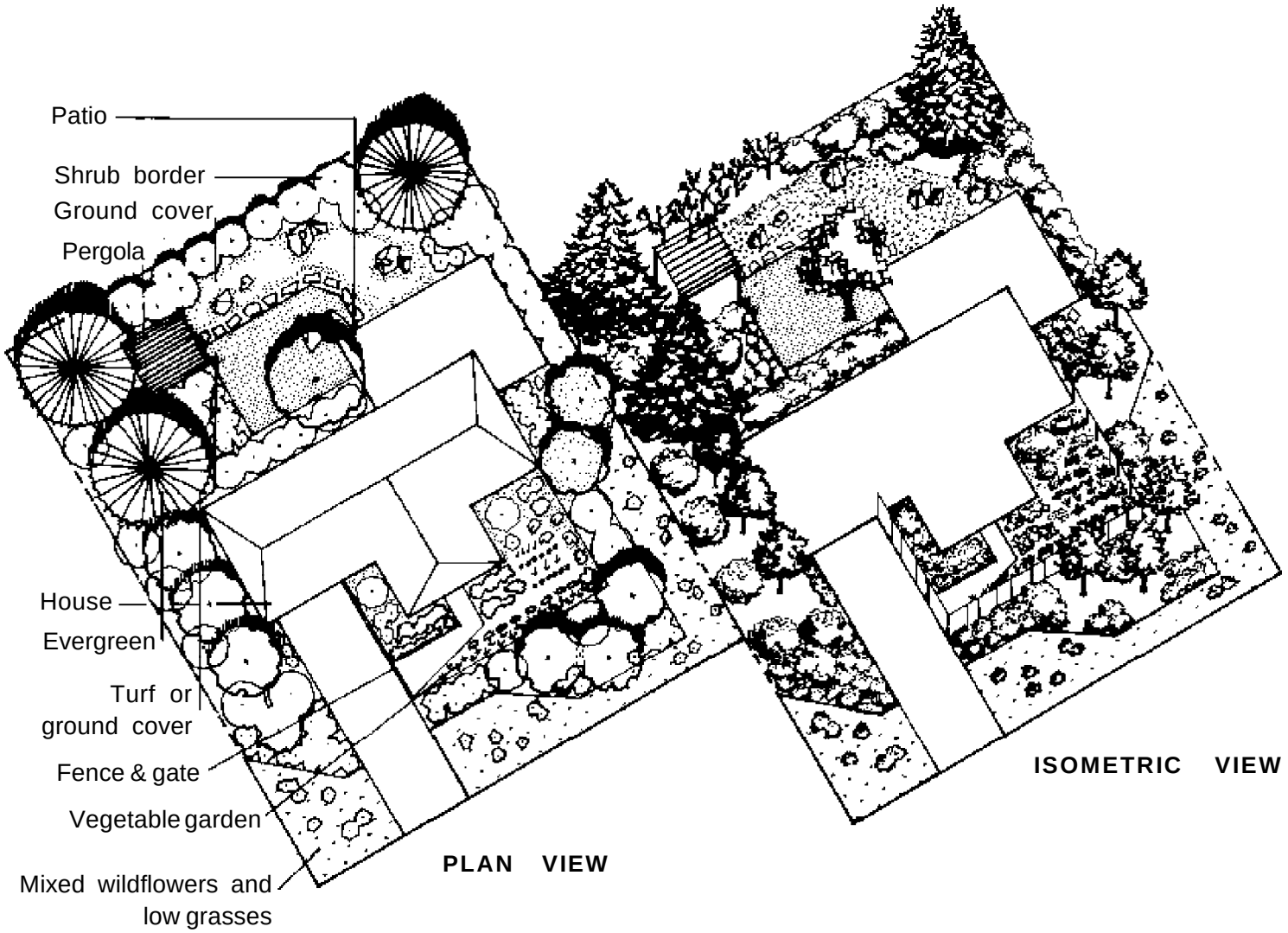
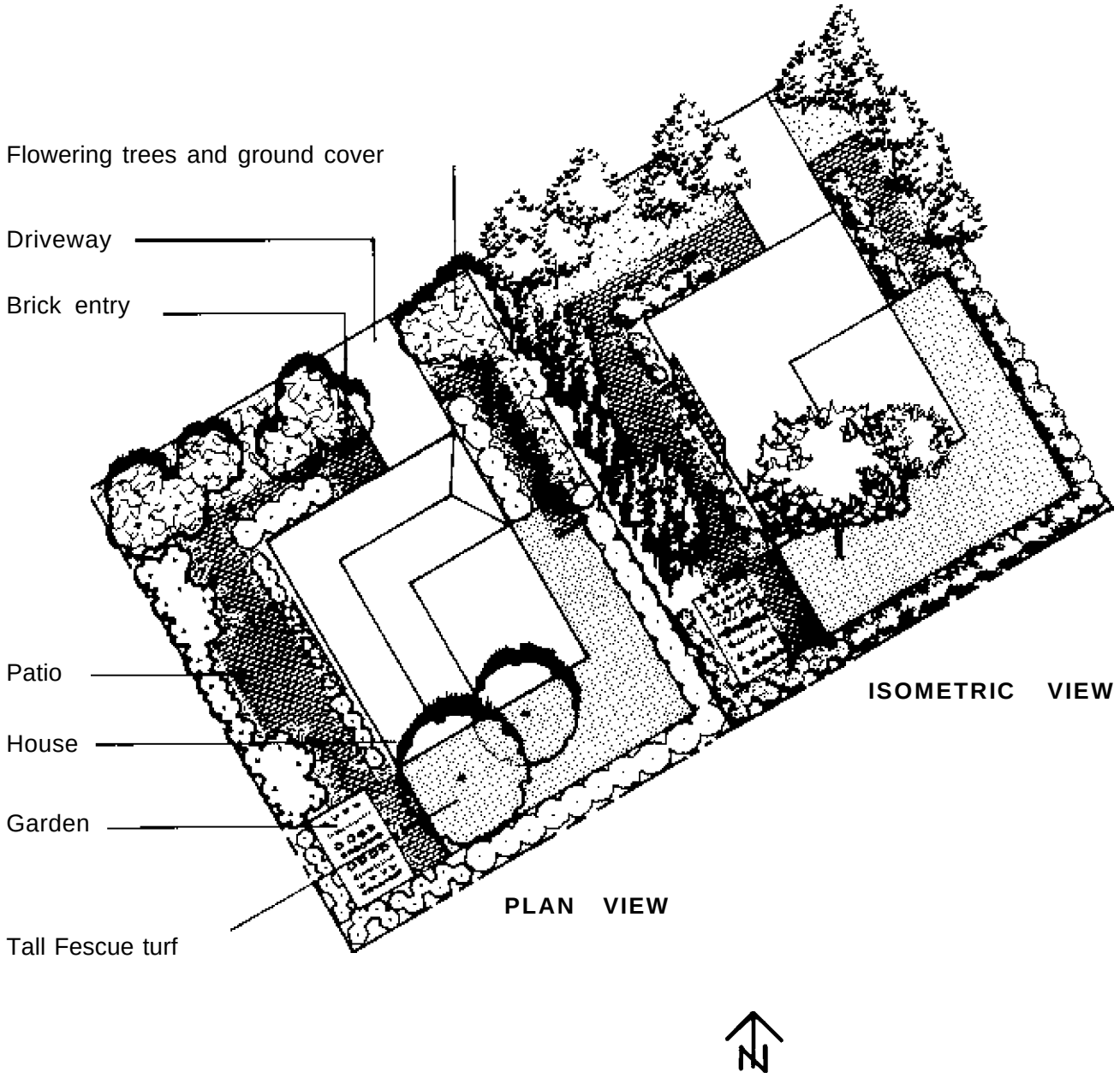


Figure 17. Angle motifs are dynamic. The entire landscape is zone 1 with the exception of the vegetable garden at the entry. Zone 0 can also be used in many areas of this design.

Figure 18. Tall Fescue turf is shown here, water zone 2, with irregular brick walkways and a brick patio. Clusters of tall columnar trees and vines are used along the west side of the house for shade. A large shade tree is shown on the south side. A small garden is included with a low shrub border. The front yard has ground cover and flowering trees.



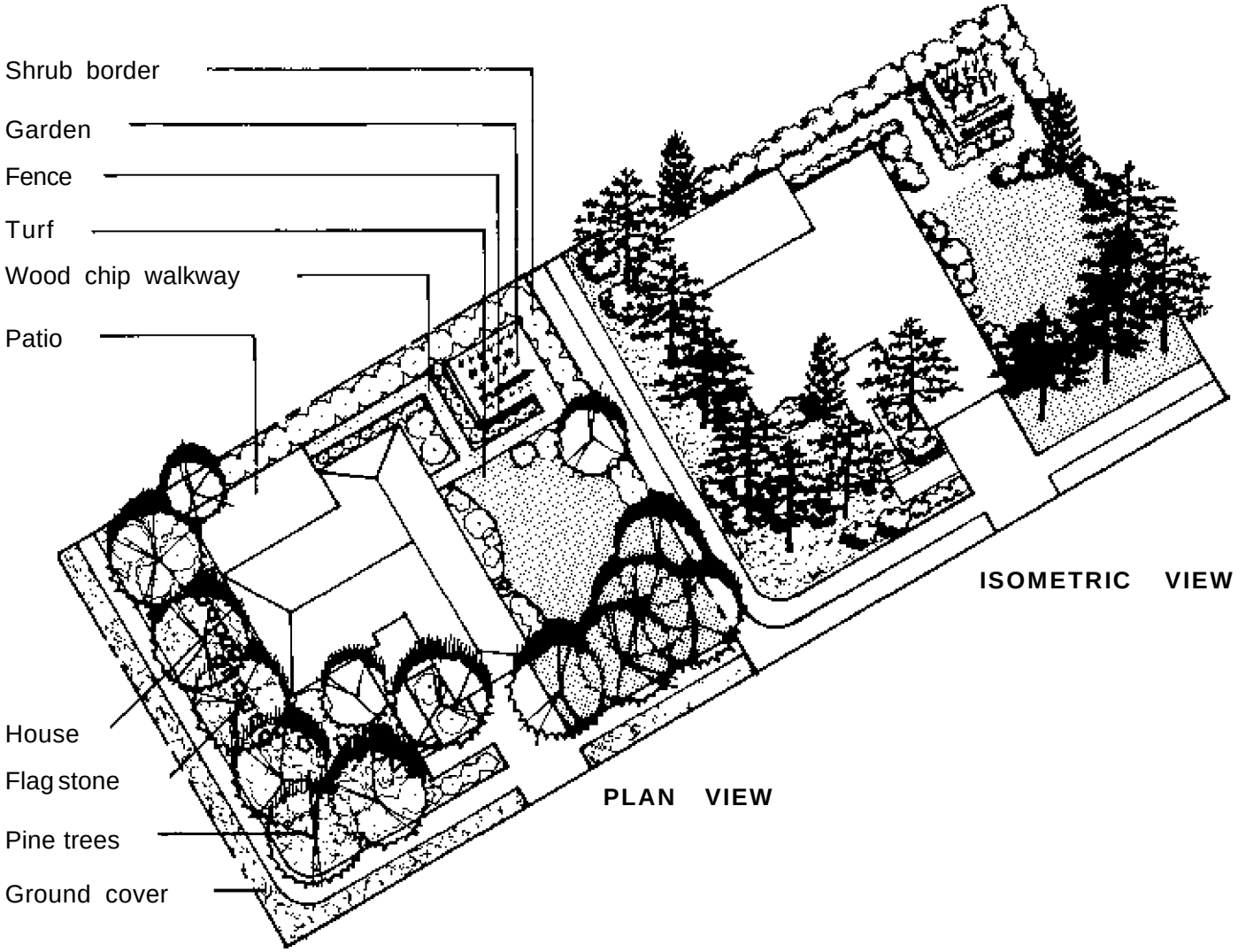


Figure 19. A wooded lot is created using tall pine trees for shade and privacy. Shrubs and ground cover are used below. Lower shrubs are used around the garden to avoid shading that area. A private entry is created with shrubs and trees.

important ground treatment in water conserving designs because they don't require water; many also help to retain moisture in the ground.

Surface materials provide an additional opportunity to visually tie the landscape together. Repeated use of one or two materials will help provide unity in the design and in the yard.

Installation of hard surface materials in a porous base such as sand, gravel or mulch will benefit surrounding plants by allowing water to move through to the root zone. Figure 20 shows wood railroad ties installed in gravel with healthy plants along the edges. This creates a functional and aesthetically pleasing walkway. It is also common to use unit pavers such as brick, asphalt, or stone set in sand and / or gravel. Pavers can also be set on soil and surrounded with 3↑ of decomposed surface mulch. Weeds will be a problem for a year or two, but the mulch eventually wins.

Concrete, as a surface or a base, is durable and requires little maintenance. It can be tinted or painted to reflect a color in your house or the landscape, and it can be stamped to provide texture and pattern. Additional gravel can be added to concrete and exposed in the finishing operation to give a durable natural look of exposed aggregate. There is also a perviously exposed aggregate material available which would be beneficial to your plants, but it is expensive.

Wood chips and shredded pole peelings are good surface materials for walkways and patios. They should be replenished every few years as they decompose, but they are light, relatively inexpensive, and easy to work with. They are a great surface material for planted areas because they keep moisture in the ground and prevent weed growth. If mulch is replenished each year for several years, weeds are seldom a problem. Woven landscape fabric installed below these materials will also prevent weed growth and still allow water to infiltrate.

Figure 20 (right). Railroad ties installed in gravel.

Pea gravel or 3/4↑ gravel, 3↑ deep, over landscape fabric makes an acceptable walkway. Gravel is available in a variety of colors to blend with your home or landscape.

It is difficult to keep wood chips or gravel contained in walkways where slopes are greater than 3%, or where children play. Edgers of wood, brick, steel or stone can be used to help contain loose surface materials. Where high winds are encountered, gravel or large wood chips are preferable to smaller materials that can be easily scattered.

There are many synthetic materials that are attractive for walkways and patios. Refer to magazines such as *Landscape Architecture* or *Architectural Digest* for ideas. Local nurseries, landscape rock and gravel companies, and building material suppliers usually have displays of materials to choose from. They also have costs which may influence your material selection.

Pictures of materials and their use in the landscape are provided in these references: *Landscaping, Western Home Landscaping, All About Landscaping, Step by Step Landscaping, The Book of Garden Design, The Small Garden* and *Backyard Design.*

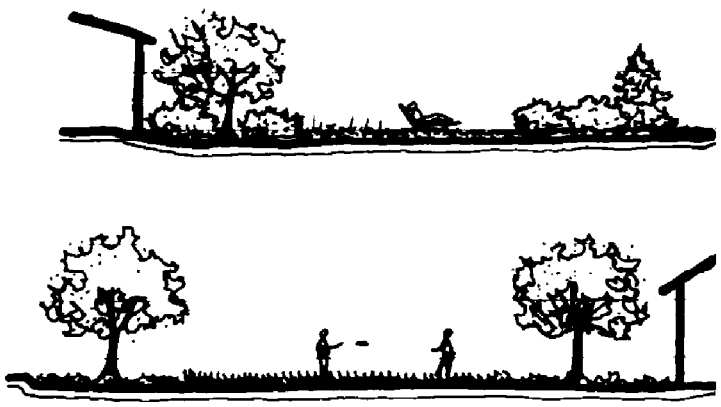


Figure 21 (left). Quick section drawings provide views of the landscape.

DESIGNING YOUR SPACE

A design can now be developed for your yard by refining the synthesis plan, and using the design principles discussed previously. On sheets of tracing paper, experiment with sizes and shapes of areas, use enclosed and open spaces. Repeat a standard module to define areas, such as the rectangle used in Figure 15, or a square or triangle. Overlay a sheet of tracing paper on your synthesis plan and outline important existing areas or structures. Is there an existing module (repeated shape) to use or do you need to define a shape to work with? Experiment with curvilinear lines and shapes (Figure 16). Try a circular or elliptical module. Combine rectangles and curvilinear lines (Figure 22).

Consider use of a variety of angles as a design element (Figure 17). Try to develop a feeling about the landscape to help you create. Use a metaphor to liken the landscape to a woodland, a garden, a play court or a wildflower meadow.

Consider the hierarchy of space sizes and their connection. Think about the compatibility of adjacent activity areas and design elements needed to facilitate the uses. Make small section drawings at the same scale as your plan (1↑= 40′ or 1↑= 10′) for another view of your ideas, and add people to give a more understandable sense of scale (Figure 21).

Measure the spaces that you are creating to see that they conform to the sizes needed for particular uses such as badminton, entertaining or gardening. Adjust space sizes but retain the theme and flow of your design. Review the design principles again and check to see that they have been addressed.

ADDING PLANT MATERIALS

Once you are satisfied with the spatial arrangement and the shapes and function of the design, use the circle template to add

vegetation. Measure the circles to find the appropriate sizes to represent plants that you want to add. If you use mature sizes, as presented in the plant lists, you will have open spaces in the landscape until the trees fill in. It is common practice to use 2/3 of the mature tree size for designing, particularly for trees with slow and moderate growth rates. Remember to use the same scale as your drawing, 1↑= 10′ or 1′= 40′. For example, the large tree canopies shown along the west side of the house in Figure 22, have a 30′ diameter using a scale of 1↑= 30′. The circles or tree canopies overlap to provide dense shade to cool the house. Asterisk shaped symbols depict evergreen trees that are used on the northeast corner of the lot (Figure 22) to create a buffer to winter winds. If your winter winds come from the north, you may add evergreen trees along the north edge of your property.

Shrub sizes are discussed in the plant section under "size." If you choose medium shrubs with a 3-6′ width, use a scaled 5′ circle to represent those shrubs; select a scaled 8′ circle for wide shrubs. Ground covers should be considered for open areas and under trees and shrubs. Use different symbols for various materials; dots are quick and easy for showing vegetative ground cover, little check marks may be used for grass and flower mixtures, and little dashes can represent woodchip pathways or mulched shrub and flower beds. Make up symbols that are fun to use and either label them or create a legend showing the symbols with their label. The design doesn't need to be fancy; the objective is for you to understand where specific materials should be used in the landscape.

Evaluate the drawings and ask yourself the following questions. Are there curved or linear paths to link spaces? What is the theme; what will be the focus? Does the design work with your house? Is there a sense of balance, or are all of the big trees on one side of the yard? Does the entry look inviting? Are you shading where it is needed, allowing light where you want it? Have you created beautiful views from key windows or positions in the yard? Have unsightly views and cold winter winds been adequately screened? Does the drainage work with the changes? Does the plan meet the requirements of local ordinances? Do you like your design?

CREATING WATER ZONES

Now overlay a clean sheet of tracing paper on your design and draw water zones (0-4) that establish the watering frequency for different areas of the landscape (Figure 14). Refer to the design section on water zoning for water zone descriptions. After reading the plant selection section you may return to this step to adjust the water zone numbers to reflect the types of plants that you chose. For example, you may designate an area for turf and label it water zone 4 for Kentucky bluegrass, but after reading about turf in the plant section you may decide to use tall fescue

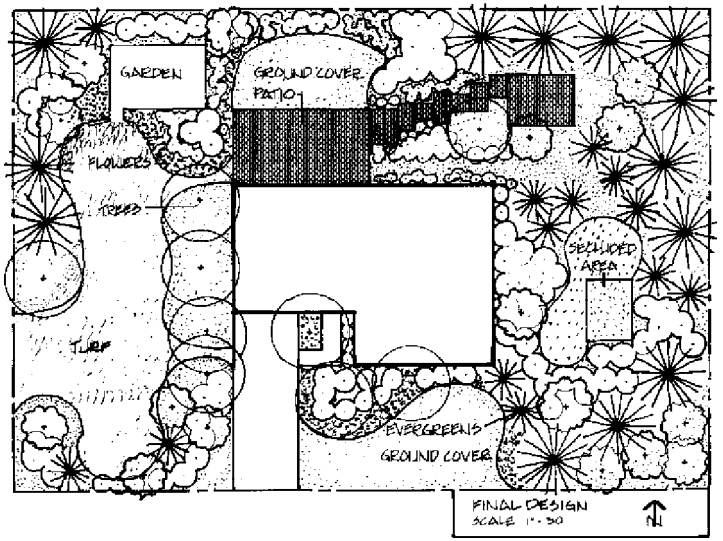


Figure 22. (right) A plan view of the final design illustrates the use of curvilinear lines and rectangles with plant materials.

turf that requires water zone 2. The water zones that you select now will give you a place to begin in the plant selection process. If you select water zone 1 for perimeter plantings, you will find a variety of trees, shrubs, perennials, annuals, and ground covers to choose from in the plant section. Make an attempt to stay with lower water zones to conserve water.

If you haven't found good solutions or answers to some of the questions presented above, rework aspects of the design until you are satisfied. Be sure that there is a strong sense of spatial interaction that facilitates a comfortable flow between interior and exterior spaces. Check the design for a comfortable fit with the land and the surroundings. Finally, have you incorporated the planning goals that you defined in the program development stage?

Plant Selection

This section provides lists of plants to choose from for your landscape design. Information gathered from the site inventory, knowledge about plant growth and use of your design intent will help you make successful plant selections for your site. These factors are also important to consider: soils, aspect of slopes, sun and shade, wind, rainfall / irrigation, and ground water; and design qualities including height, width, shape and color.

Plant selection lists in this section provide recommended irrigation frequency, hardiness, height and width, sun / shade requirements, time of flowering, leaf color, soil and water tolerances, pest problems and growth rate.

Selecting plants is a fun part of the design process for most people. Relax, let your mind play; imagine colorful trees in your yard. Envision columnar green trees, red bushy shrubs — a bank of orange and red flowers. See loose sprawling ground covers where you will no longer have to mow grass. Picture native plant areas, with interesting plant forms, and subtle colors.

DESIGN INTENT

Design intent is comprised of your goals for the landscape that encompass aesthetics, functional use and conservation. Plant materials are used to create the landscape that you define and envision.

Aesthetics

Aesthetics are an important aspect of planting compositions and species selection. The interaction of the size, form and placement will sculpt your landscape. An overhead canopy will enclose it vertically, and a shrub hedge will enclose it horizontally. Color selection and placement will effect the "mood" of the landscape. Warm colors such as yellow or red are lively and tend to stand
out, while cool colors of blue, gray and purple recede. A variety
of heights, widths, shapes, sizes, and colors will provide diversity and interest to help create the outdoor spaces you desire. Refer to the design section during the selection process to incorporate the principles of unity, variety, balance, continuity, and emphasis.

Function

Plants can be used for beauty and to define spaces for varied uses. They provide screens to block unwanted views, wind or noise, and they afford privacy when densely planted. Cool shade is a free benefit and one that will save energy if properly planned. Plants can attract wildlife by providing food and cover. They can also be used to control erosion on steep slopes. It is important to

Figure 23 (far left). A low maintenance landscape with mulched plant beds.

choose the plants that will best accomplish your purpose and fulfill the intent of your design.

Water Conservation

Selection of water conserving plants can be an objective of landscaping. When Kentucky bluegrass turf is removed and replaced by plants from water zones of 3 or less, water savings will be realized. Inherent in low water use landscapes is a new vision of what a residential landscape should look like (Figure 23). In contrast to formal traditional English landscaping, water-wise landscaping is a more environmentally sound approach that incorporates natural plant forms, greater plant diversity, hard surface areas and water zoning in a planned landscape. Water zoning is critical to the future of water conservation and plants should be carefully selected to create successful low water use zones.

Plants can be selected from the lists based on size, seasonal color and growth rate. Plant form and texture are also important for your design. Refer to the following books for this information and pictures: *Trees of North America, Water-Saving Gardening, New Western Garden Book, Pictorial Guide to Perennials, Shrubs and Hedges,* and *Manual of Woody Landscape Plants.*

ENVIRONMENTAL CONSIDERATIONS

Soils

Most plants prefer moist, well drained soils. Assume this for the plants listed unless otherwise specified in the remarks column of the plant tables. While plants grow best in a particular soil, they may tolerate a range of soils from sands to clays, high salt content, or a high water table. Aeration, moisture availability and nutrition influence plant tolerance of different soils. Junipers for example, do not like "wet feet" caused by poor drainage; they survive with good drainage, aeration and nutrition, and they are tolerant of drought. Red twig dogwood thrives with "wet feet" from a high water table, but it is also quite drought tolerant. Big sagebrush tolerates salts and drought but it is intolerant of poorly drained soils. Mountain plants usually grow in more acidic soils, and they often require more iron in alkaline soils. Some of your success with plant survival in various soils will likely be a result of trial and error, but reading and talking with other gardeners and landscapers will increase your odds for success!

Aspect

The aspect of slopes is important to plant survival. This is apparent in the natural landscape, particularly in the foothills and mountains. Douglas fir trees grow on north facing slopes and in cool, moist ravines, while Utah junipers often grow on sunny south facing slopes (Figure 24). Bigtooth maples grow in clusters along drainageways, not on ridges. Rocky Mountain maples grow on north facing slopes where there is moisture and protection from hot winds. These observations suggest that Utah junipers will not grow well on the north side of a house, while the Rocky Mountain maples and Douglas fir may thrive there.

Because most house sites are graded flat, it is important to determine where the north side building shadows and the hot southern exposures will be.

Sun and shade are critical to plant growth. Some plants will only grow in sun and others only survive in shade. If an area is in shade for half of the day or more, plant shade tolerant plants there. As plants grow they will shade lower plants, particularly on their north side, so it is important to consider where plant shadows will be, and plant accordingly.

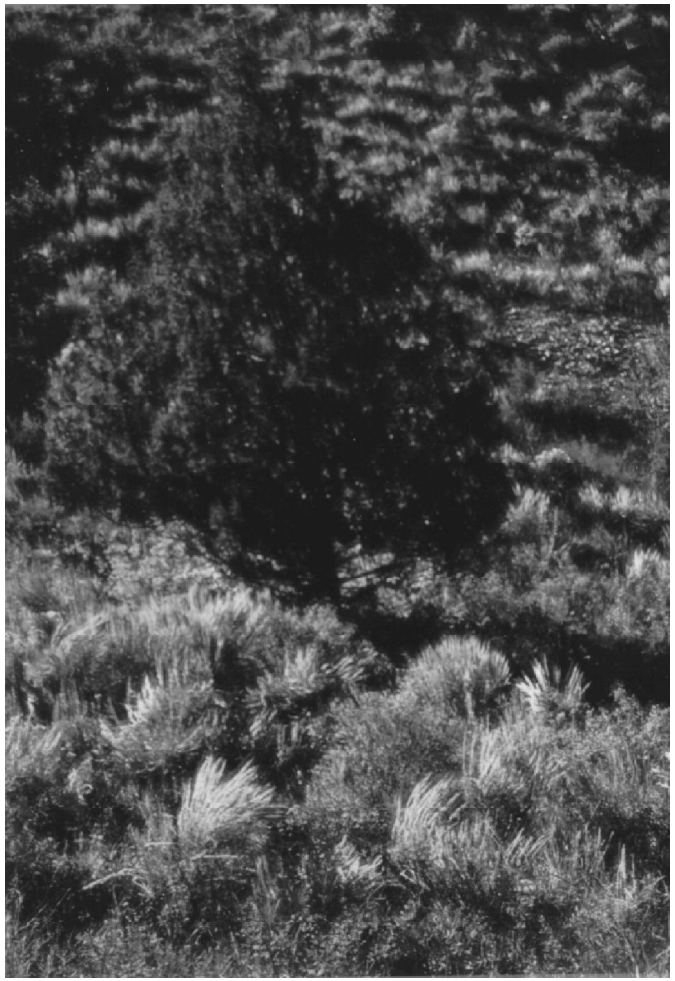


Figure 24 (right). Utah juniper and big sagebrush on a south facing slope.

In the foothills, snowberries, wild roses and creeping mahonia often grow in shade of chokecherries and maples. A snowberry would struggle to survive as a foundation planting on the south or southwest side of a house because of the intense heat. It will grow in sun with leafy companion plants that provide light shade and cooling. Petunias and marigolds, colorful annuals, prefer sunny border positions, while impatiens and begonias thrive in the shade of other plants. The sun / shade column (Plant Selection Guide p. 37) indicates if the plant prefers sun, shade, light sun (lt. sun), or light shade (lt. shade). If the column indicates sun or shade, the plant can grow in either.

Wind

Cold or prolonged hot winds can be damaging to plants. Desiccation, or drying, is accelerated by wind, and after several days of heat and abnormally high winds, it may be necessary to irrigate to restore soil moisture. Plants that are sensitive to hot or cold wind should be planted in protected sites. Plants that normally grow on north facing slopes should also be protected from hot, dry, summer winds in the valleys. Protection from wind can help low water use plants survive without frequent irrigation.

Protection from wind can be provided by dense tree and shrub companion plantings or structures. Companion plantings are comprised of plants that benefit by growing together. Where hot wind can be a limiting growth factor, a hardy Austrian pine can be planted as a wind and heat shield for a sub-alpine fir. The fir would burn on the south side without the protection of the

pine. Your house can screen hot southeasterly winds for firs or Rocky Mountain maples planted on the north side. If you wonder how to develop companion plantings, take a hike in the mountains and write down the plant communities that you see there, taking note of the slope aspect, sun / shade and moisture. These two publications are good plant references with pictures: *Mountain Plants of Northeastern Utah* and *Common Native Trees of Utah.*

Precipitation and Irrigation

Precipitation in the valleys of northern Utah averages about 14↑ per year and increases with elevation. The change in rainfall is evident in the landscape. Grasses and forbs predominate where there is lower rainfall. As rainfall increases more shrubs are found, then shrubs and trees, progressing to taller evergreen and deciduous forests. If we are attempting to grow evergreen trees in the valleys, the challenge is to determine what their natural and adapted site and water requirements are. Some site requirement information is provided in the tables. There are also people in this region who have learned about plant requirements from trial and error. Seek them out.

PLANT LIST

The plant list (Plant Selection Guide p. 37) contains sections for trees, shrubs, perennials, annuals, ground covers and turf. Each section is divided into water zones 0 - 4, and plants are listed in appropriate zones. The following information is provided to assist you with plant selection: hardiness, size, leaf / flower color and the time of year that the color occurs, evergreen / deciduous, and remarks.

Water Zones

Five water zones are presented to facilitate *selection of plants with similar water requirements,* and as an *irrigation guide for use after the establishment period of 1 to 2 years.* Water zones range from 0, no irrigation to 4, irrigation two times per week. Water zone irrigation timing should be accompanied by soil moisture checking. The most assured method of determining when and how much to irrigate is to check the soil and to irrigate if it is barely moist, with enough water to wet the root zone.

- **Zone 0** means that little or no irrigation is required. Plants in this zone will be drought tolerant native or naturalized plants. During extended hot spells they may need some irrigation.
- **Zone 1** plants will need a monthly irrigation. During extremely hot or windy weather they may need an additional irrigation.
- **Zone 2** plants require irrigation once every 2 weeks. They may also require an additional irrigation during hot spells.
- **Zone 3** plants require weekly watering.
- **Zone 4** plants are shallow rooted or water loving. They need irrigation twice per week.

A high water table zone is used for plants that prefer to grow with their roots in water most of the time. These plants may also be capable of growing in another water zone, as indicated in the remarks.

Hardiness

USDA hardiness areas 4 and 5 are shown as a guide for plant selection (Figure 2). Choose plants with a numbered zone equal to or less than your zone. If you live in area 4, use plants for area 4 only; if you live in area 5, use plants for areas 4 and 5. Many of these plants are hardy in colder areas, but this guide has been simplified to identify plants suitable for areas 4 and 5 only.

Figure 25 (right). Fall color from yellowing iris leaves and junipers in the foreground and from red spreading cotoneaster in the middleground.

Size

Trees are categorized by height: low (0-25′), medium (25-40′), tall (40′+); and width: narrow (0-10′), medium (10-20′), wide (20′+). Shrubs are grouped into two height ranges: over 6′ and under 6′, by width or spread: narrow (0-3′), medium (3-6′), wide (6-10′), and very wide (10′+). Mature sizes are used throughout and sizes will vary with soil, water and site conditons.

Color

Leaf and flower color are listed along with the average time of year the color occurs.

Evergreen/Deciduous

Evergreens retain green leaves throughout the year. Deciduous plants shed their leaves in the fall.

Perennials/Annuals

Perennials are non-woody plants that live year round, but their stems die back during the winter in cold climates. Annuals complete their lives in one year, often reseeding themselves. Plants that are considered annuals here may grow as perennials in warmer climates. In protected sites you may find “annuals” lasting through the winter and flourishing with the onset of spring.

Remarks

The remarks column provides information to assist with selection and care of plants. Problems are indicated, such as invasive; and tolerances to wind and drought are mentioned along with special plant requirements. Growth rate and potential pests are noted for trees — don’t let these scare you off — just understand what the pests are and watch for them. Additional information can be found in the references listed at the end of this section. Appendices are included on sources of plants and seeds, and on plant selection for wildlife.

Nomenclature

In general discussion the common name is used to identify a plant, like pinyon pine. The scientific name, *Pinus edulis,* is the Latin name used to classify plants. *Pinus* is the genus and *edulis* is the species.

Included with the genus and species, there may be a variety (*Berberis thunbergii atropurpurea*), or there may be a cultivar listed (*Acer platanoides ‘Crimson King’*). These plants have characteristics that are different from the species (*Berberis thunbergii* or *Acer platanoides*).

SELECTING PLANTS

Using your design, identify the most important planting area and its assigned water zone. Think about the environmental aspects of plant selection and choose plants for specific soils, aspect, light and wind exposure. Determine the size of trees or shrubs desired, then proceed to that section of the plant list. Once you have selected a plant that contributes to your design intent, choose other plants from the same water zone that will be aesthetically compatible. Select the largest plants first, then the medium sizes, and finally the flowers and ground covers. You now have a plant palette. It may be helpful to refer to the design principles again: unity, variety, balance, emphasis and continuity, to help you fulfill your design intent.

Use your plant palette, with modifications, for other planting beds. Remember the functional aspect of plantings as they relate to planned activities. For example, a border planting used to define a play area should not be comprised of delicate flowers that are easily damaged by impact. Low growing junipers are more tolerant of "play" abuse.

Let's create a planting for the north side of a house in Salt Lake City. The objective is to cover the ground, create a pleasant appearance, and minimize water use. It is a protected low use area with loam soils.

Starting with the design, it appears that the entire area is in water zone 2 and in partial shade. Because trees occupy so much space, they are selected first. From the tall tree section we might choose a sub-alpine fir: water zone 2, tolerant to area 4 (including 5), shade tolerant, and needs some protection from hot wind. From reading about sub-alpine fir in the references it is obvious that they get large. The design indicates that there is room for three firs, and there is good space to create a thicket of smaller trees in front of the firs (Figure 26).

From the water zone 2 list, Amur maple could be used, but we like the look of Rocky Mountain maple (zone 1) with the green firs behind. Can zone 1 plants be used with zone 2 plants? In this case yes, the maples would not be harmed by the additional irrigation for zone 2. It would not work to combine a tree such as curlleaf mountain mahogany (zone 0) with the fir for two reasons: the mahogany likes full sun, and it will not tolerate the additional water needed by the fir.

Use of lower horizontal shapes will help the eye connect the vertical lines of the trees with the ground plane. Common juniper tolerates light shade, it tolerates zone 1, but it will thrive with zone 2 watering. Snowberry can be interspersed in clusters among the juniper for interest. Patches of wild geraniums and small clumps of rock cress and bugleweed will add additional color and complete the selection. The maples will also provide orange fall color while the firs remain green, providing winter color.

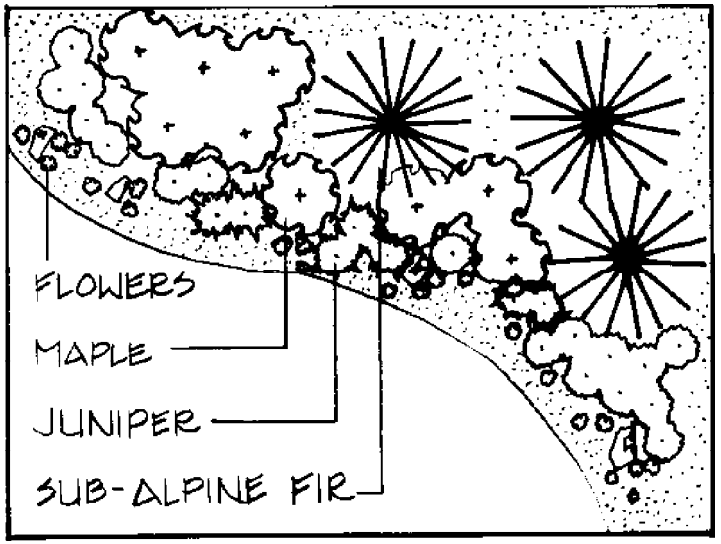


Figure 26 (left). Plant material selection for a shaded area.

Plant Selection Guide

TALL TREES (40'+)

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 0 (no irrigation)						
Observe plants to be sure they are adapting to this no irrigation schedule. If you see signs of stress, it is possible that they aren't adequately established to survive without supplemental water. Check the soil and irrigate infrequently if necessary.						
Siberian Elm *Ulmus pumila*	4	deciduous *messy, hardy, tolerant, spreads by seed, invasive, fast growing*	wide	sun		
WATER ZONE 1 (1 irrigation per month)						
Refer to the comments above for water zone 0. Provide additional water if necessary, particularly during establishment.						
Tree of Heaven *Ailanthus altissima*	4	deciduous *pollution tolerant, verticillium wilt, fast*	wide	sun		bronze, spring
Incense Cedar *Calocedrus decurrens*	5	evergreen *drought tolerant, heart rot*	narrow	sun		green
Common Hackberry *Celtis occidentalis*	4	deciduous *tolerates clay soil, witches broom, moderate*	wide	sun	yellow, spring	yellow, fall
Black Locust *Robinia pseudoacacia 'Purple Robe'*	4	deciduous *tolerant, locust borers, leaf miners, fast*	wide	sun	white, summer	yellow, fall

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 2 (2 irrigations per month)						
White Fir	4	evergreen	wide	sun, shade		blue or green
Abies concolor	*prefer lower pH, slow–moderate, may be zone 1, protect from hot wind*					
Sub-Alpine Fir	4	evergreen	medium	sun, shade		green
Abies lasiocarpa	*cluster for survival and aesthetics, slow-moderate, shade south side*					
Sycamore Maple	4	deciduous	wide	sun		green
Acer pseudoplatanus 'Atropurpurea'	*interesting bark, leaf scorch, aphids, verticillium, moderate*					
Southern Catalpa	5	deciduous	wide	sun, lt. shade	white, spring	green
Catalpa bignonioides	*tolerates heat, moderate–fast*					
Western Catalpa	4	deciduous	wide	sun	white, spring	green
Catalpa speciosa	*tolerates heat, sphinx moth larvae, verticillium, moderate*					
Autumn Purple Ash	4	deciduous	medium	sun		purple, fall
Fraxinus americana 'Americana'	*scale, borers, moderate*					
Marshall's Seedless Ash	4	deciduous	wide	sun		yellow, fall
Fraxinus pennsylvanica 'Marshall's Seedless'	*scale, borers, moderate*					
Ginkgo	4	deciduous	medium	sun		yellow, fall
Ginkgo biloba 'Autumn Gold'	*attractive leaves, slow–moderate*					
Shademaster Honeylocust	4	deciduous	wide	sun		yellow, fall
Gleditsia triacanthos 'Shademaster'	*pod gall midge, canker, fast*					
Black Walnut	4	deciduous	wide	sun		yellow, fall
Juglans nigra	*tolerant, taproot, difficult to transplant, inhibits growth of vegetables and flowers*					
Norway spruce	4	evergreen	wide	sun		green
Picea abies	*no clay soils, spruce gall adelgid, borers, tussock moth, scale, moderate–fast*					
Colorado Spruce	4	evergreen	wide	sun		green
Picea pungens 'Glauca' var. *'Glauca'*	*spruce gall adelgid, tussock moth, scale, slow–moderate, may be zone 1 with deep watering*					blue

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Austrian Pine *Pinus nigra*	4	evergreen	wide	sun		green
	tolerates clay, scale, moderate–slow					
Scotch Pine *Pinus sylvestris*	4	evergreen	wide	sun		green
	attractive bark, aphids, rust, borers, wood rot, scale, may need additional water occasionally					
Sycamore *Platanus x acerifolia* *'Bloodgood'*	4	deciduous	wide	sun, lt. shade		green
	tolerant, canker stain, powdery mildew, anthracnose, borer, moderate					
Douglas Fir *Pseudotsuga menzeisii*	4	evergreen	wide	sun, shade		green
	slightly acid soil, spruce gall adelgid, moderate					
Bur Oak *Quercus macrocarpa*	4	deciduous	wide	sun		yellow fall
	specimen, tolerant, sand–clay, borers, gall, leaf spot, slow					
Japanese Pagoda Tree *Sophora japonica*	4	deciduous	wide	sun	white, summer	green
	interesting pods, no clay, leaf hoppers, moderate–fast					
Japanese Zelkova *Zelkova serrata* *'Green Vase'*	4 / 5	deciduous	wide	sun		bronze, fall
	moderate					

WATER ZONE 3 (1 irrigation per week)

Norway Maple *Acer platanoides* *'Emerald Queen'* *'Crimson King'*	4	deciduous	wide	sun		yellow, fall red
	tolerant sand–clay, verticillium wilt, aphids, anthracnose, moderate					
European White Birch *Betula pendula* *var gracilis*	4	deciduous	wide	sun		gold, fall
	rapid, borer, canker *weeping*					
Atlas Cedar *Cedrus atlantica* *'Glauca'*	5 / 6	evergreen	wide	sun, lt. shade		green blue
	specimen, no wet soils, fast then slow					
American Sweetgum *Liquidambar styraciflua* *'Burgundy'*	5	deciduous	medium	sun, lt. shade		red, fall
	star shaped leaf, scale, iron chlorosis, moderate					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Silver Poplar	4	deciduous	wide	sun		green
Populus alba	*moderate, roots invasive, borer, canker, aphids*					
'Bolleana'	*columnar*		narrow			
Fremont Cottonwood	4	deciduous	wide	sun		yellow, fall
Populus fremontii	*tent caterpillar, canker, leaf spot*					
Quaking Aspen	4	deciduous	medium	sun, lt. shade		yellow, fall
Populus tremuloides	*suckers, good for thickets, borers, canker, leaf spot, fast*					
American Arborvitae	4	evergreen	medium	sun		green
Thuja occidentalis	*bag worm, spider mites, slow–moderate, susceptible to winter burn*					
'Pyramidalis'			narrow			
American Linden	4	deciduous	wide	sun, lt. shade	white, spring	yellow, fall
Tilia americana	*leaf blight, canker, borers, moderate*					
Littleleaf Linden	4	deciduous	medium	sun	white, spring	yellow, fall
Tilia cordata *'Greenspire'*	*pyramidal, fragrant, leaf blight, canker, borers, moderate*					

HIGH WATER TABLE (little or no irrigation)

Boxelder	4	deciduous	wide	sun, shade		yellow, fall
Acer negundo	*spreads-invasive, boxelder bugs, drought tolerant, possibly zone 1 after many years, fast*					
White Alder	4	deciduous	medium	sun, shade		
Alnus incana	*attractive seeds and bark*					
Water Birch	4	deciduous	medium	sun		
Betula occidentalis	*attractive red bark, will survive in water zone 2 near lawn*					
Narrowleaf Cottonwood	4	deciduous	wide	sun		yellow, fall
Populus angustifolia	*once established could survive in zone 2*					
Cottonwood	4	deciduous	wide	sun		yellow, fall
Populus deltoides	*cottonless, drought tolerant, will survive zone 1 after many years, fast*					
Weeping Willow	4	deciduous	wide	sun		yellow, fall
Salix babylonica	*canker, scale, aphids, carpenter worm, invasive roots, fast, survives in water zone 3*					
Globe Willow	4	deciduous	wide	sun		yellow, fall
Salix matsudana	*slime flux, aphids, scale, invasive roots, fast, survives water zone 3*					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME

MEDIUM TREES (25-40')

WATER ZONE 0 (no irrigation)

Observe plants carefully to be sure they are adequately established and able to survive without additional water. Over watering may kill them.

Russian Olive	4	deciduous	wide	sun	white, spring	gray, green
Elaeagnus angustifolia	*thorns, fragrant, tolerates gravelly soil, fireblight, aphids, fast, tolerates high water table*					
Utah Juniper	4	evergreen	medium	sun		green
Juniperus osteosperma	*tolerates heat, likes southern exposures*					

WATER ZONE 1 (1 irrigation per month)

Refer to statement above for zone 0 trees. With adequate shade and wind protection, some of these plants will survive without irrigation. However, with wind exposure and hot south or west exposures, they may require additional water. Check soils and observe the trees.

Bigtooth Maple	4	deciduous	wide	sun, lt. shade		orange, fall
Acer grandidentatum	*shrub/tree, clusters, may benefit from some protection*					
Rocky Mountain Juniper	4	evergreen	medium	sun		blue, green
Juniperus scopulorum	*many cultivars*					
Bristlecone Pine	4	evergreen	wide	sun		green
Pinus aristata	*accent, slow*					
Pinyon Pine	4	evergreen	medium	sun		green
Pinus edulis	*edible nut, scale, slow*					
Mugo Pine	4	evergreen	medium	sun, lt. shade		green
Pinus mugo	*size varies, rust, borers, scale, slow*					
Idaho Locust	4	deciduous	medium	sun	purple, summer	green
Robinia x ambigua 'Idahoensis'	*suckers, extremely invasive, thorny, drought tolerant, canker, borer, leaf spot, fast*					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 2 (2 irrigations per month)						
Hedge Maple	4	deciduous	wide	sun, lt. shade		yellow, fall
Acer campestre	*tolerates alkali and drought, aphids, verticillium, slow*					
Flowering Pear	4	deciduous	medium	sun	white, spring	red, fall
Pyrus calleryana	*fireblight, fast*					
'Aristocrat'	*more drought tolerant*					
European Mountain Ash	4	deciduous	medium	sun	white, spring	rust, fall
Sorbus aucuparia	*orange fruit, more acidic soil, no clay or compacted soils, fireblight, scale, borers, canker, moderate*					
Japanese Tree Lilac	4	deciduous	wide	sun	white, summer	
Syringa reticulata	*distinguished shape, tolerant, lilac borer, powdery mildew, moderate*					
Chinese Date	4	deciduous	medium	sun	yellow, spring	yellow, fall
Zizyphus jujuba	*thorns, tolerant alkaline soil, root rot, moderate*					
WATER ZONE 3 (1 irrigation per week)						
Eastern Redbud	4	deciduous	medium	sun, lt. shade	pink, spring	yellow, fall
Cercis canadensis	*heart shaped leaves appear after blooms, no wet soils, canker, verticillium, possibly zone 2, moderate*					

LOW TREES (0-25')

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 0 (no irrigation)						
Observe plants for adequate establishment and response to no irrigation. Irrigate if necessary, frequent watering will kill them.						
Curlleaf Mountain Mahogany	4	evergreen	medium	sun, shade		green
Cercocarpus ledifolius	*specimen or hedge, tree/shrub, may need occasional watering during initial 3 years, slow*					
Gambel Oak	4	deciduous	narrow	sun		red, fall
Quercus gambelii	*cluster for aesthetics and survival, need mulch, may need occasional irrigation, moderate*					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME

WATER ZONE 1 (1 irrigation per month)

Refer to statement for water zone 0, recognizing that some plants may need more / less water, depending on conditions; and some trees take longer to become established.

Rocky Mountain Maple *Acer glabrum*	4	deciduous	medium	sun, lt. shade		orange, fall
	thickets or single, dwarfed by heat, provide some protection					
Saskatoon Serviceberry *Amelanchier alnifolia*	4	deciduous	medium	sun, shade	white, spring	red, fall
	tree/shrub, fragrant flowers, edible fruit, rust					
Chokecherry *Prunus virginiana*	4	deciduous	medium	sun, shade	white, spring	red, fall
	clusters, prefers moist soils, edible fruit					

WATER ZONE 2 (2 irrigations per month)

Amur Maple *Acer ginnala*	4	deciduous	medium	sun, lt. shade	cream, spring	red, fall
	tree/shrub, fragrant, tolerates sand and clay, aphids, verticillium, iron chlorosis, moderate					
Seiryu Japanese Maple *Acer palmatum* *'Seiryu'*	5	deciduous	medium	lt. shade, sun		yellow, fall
	slow–moderate					
Smoke Tree *Cotinus coggygria* *'Royal Purple'*	5	deciduous	medium	sun	purple, spring	purple
	tree/shrub, purple plumes, verticillium, moderate					
Scarlet Hawthorn *Crataegus laevigata* *'Paulii'*	4	deciduous	medium	sun	red, spring	red, fall
	red fruit, fireblight, aphids					
Goldenrain Tree *Koelreuteria paniculata*	4 / 5	deciduous	wide	sun	yellow, summer	yellow, fall
	verticillium, moderate					
Lavelle Hawthorn *Crataegus x lavallei*	4	deciduous	medium	sun	white, spring	bronze, fall
	purple fruit, persistent, fireblight, aphids					
Dwarf Alberta Spruce *Picea glauca* *'Conica'*	4	evergreen	narrow	sun, lt. shade		green
	slow, allow 2 years for establishment					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Dwarf Blue Spruce	4	evergreen	narrow	sun, shade		blue, green
Picea pungens *'Baby Blue Eyes'*	*slow, allow two years for establishment*					
Bosnian Redcone Pine	5	evergreen	medium	sun		green
Pinus leucodermis *'Heldrichii'*	*nice shape, slow*					
Columnar Scotch Pine	4	evergreen	narrow	sun		blue, green
Pinus sylvestris *'Fastigiata'*	*no clay soils, slow–moderate*					
Buckthorn	4	deciduous	medium	sun, lt. shade	cream, spring	yellow, fall
Rhamnus frangula *'Asplenifolia'* *'Columnaris'*	*no clay soils, don't over water, fungus, moderate–fast* *columnar, hedge, fast*					

WATER ZONE 3 (1 irrigation per week)

Crabapples	4	deciduous	medium	sun	varies, spring	varies, fall
Malus sp.	*flower and leaf colors vary, aphids, fast, many cultivars*					
'Radiant'	*more hardy*				red, spring	red to green
Wisteria	5	deciduous	medium	sun, shade	varies, spring	yellow, fall
Wisteria sinensis	*flowers white or purple, vine or tree, no wet soils, likes iron*					

SHRUBS OVER 6 FEET TALL

WATER ZONE 0 (no irrigation)

Observe shrubs, water if there are signs of stress and wilting. Some shrubs are slow to establish and may require irrigation for more than one year. Depending on site conditions they may require occasional irrigation during long dry spells.

Mountain Mahogany	4	deciduous	medium	sun	cream, spring	bronze, fall
Cercocarpus montanus	*spiral seeds, no clay soil*					
Smooth Sumac	4	deciduous	very, wide	sun	white, summer	red, fall
Rhus glabra	*red seed heads, suckers, no clay soil, drought and heat tolerant*					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME

WATER ZONE 1 (1 irrigation per month)

Refer to statement above for water zone 0; apply additional water if necessary and cut back on watering when you can.

Siberian Pea Shrub	4	deciduous	very wide	sun	yellow, spring	yellow, fall
Caragana arborescens	*small spines, hardy, tolerant of heat, soil and wind*					
Junipers	4	evergreen	medium to wide	species specific		green to blue,
Juniperus sp.	*great variety, consult nursery, no wet soils, heat tolerant*					
Cutleaf Smooth Sumac	4	deciduous	wide	sun	white, summer	red, fall
Rhus glabra 'Lanciniata'	*red seed heads, suckers, no clay soils*					
Staghorn Sumac	4	deciduous	very, wide	sun	yellow, summer	red, fall
Rhus typhina	*red seed head, suckers, no clay soils, larger than smooth sumac*					
Woods Rose	4	deciduous	wide	sun, shade	pink, summer	red, fall
Rosa woodsii	*a wild rose look*					

WATER ZONE 2 (2 irrigations per month)

These plants may need additional water during prolonged hot / dry spells.

Red Twig Dogwood	4	deciduous	wide	sun, shade	white, spring	red, fall
Cornus sericea 'Baileyi' 'Flavermea'	*red bark, likes water, drought tolerant, adjacent to lawn survives zone 1 yellow bark*					
Peking Cotoneaster	4	deciduous	medium	sun	white, spring	orange, fall
Cotoneaster acutifolius	*small black fruits persistent*					
Spreading Cotoneaster	4	deciduous	wide	sun, lt. shade	pink, spring	red, fall
Cotoneaster divaricatus	*interesting branching, no clay soils*					
Lynwood Gold Forsythia	4	deciduous	wide	sun, shade	yellow, spring	green
Forsythia x intermedia	*prune after flowering*					
Tatarian Honeysuckle	4	deciduous	wide	sun, shade	varies, spring	green
Lonicera tatarica 'Arnold Red' 'Zabellii'	*also white, pink, aphids*				red	

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Sweet Mockorange, *Philadelphus x coronarius 'Aureus'*	4	deciduous	wide	sun, lt. shade	white, spring	yellow, green
	fragrant flowers, drought tolerant, zone 3 in hot sun					
Double Mockorange, *Philadelphus x virginalis 'Minnesota Snow'*	5	deciduous	wide	sun, lt. shade	white, summer	yellow, green
	zone 3 in hot sun					
Purple Leaf Sand Cherry *Prunus x cistena*	4	deciduous	wide	sun	pink, spring	purple, fall
	purple fruits					
Scarlet Pyracantha *Pyracantha coccinea 'Wyatti'*	5	deciduous	wide	sun, shade	white, spring	red, fall
	orange berries in fall, protect from wind, zone 3 in hot sun					
Rugosa Rose *Rosa rugosa 'Persian Yellow'*	4	deciduous	medium	sun	rose, spring	orange, fall
	a wild rose look, tolerates clay soil, wind, drought, aphids					
	more tolerant variety			yellow		
Blue Elderberry *Sambucus caerulea 'Glauca'*	4	deciduous	wide	sun, lt. shade	white, summer	green
	zone 3 in hot sun					
Chinese Lilac *Syringa x chinensis*	4	deciduous	wide	sun	lavender, spring	green
	delicate leaves and flowers					
Common Purple Lilac *Syringa vulgaris 'Alba'*	4	deciduous	wide	sun	varies, spring	green
	species is purple, hybrids: white, red, blue, purple depending on variety, good hedge					
				white		

WATER ZONE 3 (1 irrigation per week)

Sweet Shrub *Calycanthus floridus*	4/5	deciduous	medium to wide	sun, shade	red, summer	yellow, fall
	fragrant					
Burning Bush *Euonymus alatus 'Compactus'*	4	deciduous	medium to wide	sun, shade	white, spring	red, fall
	brilliant, no wet soils, slow–moderate					
Japanese Euonymus *Euonymus japonica 'Aero-marginata'*	5	evergreen	medium	sun, shade	white, summer	yellow or green
	no wet soils					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
'Grandifolia' *'Silver King'*						
Manhatten Euonymus *Euonymus kiautschovica*	5	evergreen	medium	sun, shade	white, summer	green
	protect from winter wind, attracts bees					
Rose of Sharon *Hibiscus syriacus*	5	deciduous	wide	sun, lt. shade	varies, summer	
	white, red or purple flowers; single and double varieties, moist soil					
Beauty Bush *Kolkwitzia amabilis*	5	deciduous	wide	sun	pink, summer	red, fall
Golden Privet *Ligustrum x vicaryi*	5	deciduous	medium to wide	sun, lt. shade		yellow
	yellow foliage, no wet soils					
Cheyenne Privet *Ligustrum vulgare 'Cheyenne'*	4	deciduous	very wide	sun, shade	pink, summer	green
	no wet soils					
Oregon Grape *Mahonia aquifolium*	5	evergreen	medium	shade, sun	yellow, spring	purple, fall
	prickly, protect from winter wind					
Eastern Pussywillow *Salix discolor*	4	deciduous	very wide	sun	white, spring	yellow, fall
	likes water, drought tolerant					
American Elderberry *Sambucus canadensis*	4	deciduous	wide	sun	white, summer	green
	edible purple fruit, suckers					
Bridal Wreath Spiraea *Spiraea x vanhouttei*	4	deciduous	very wide	sun	white, summer	orange, fall
	no wet soils					
Japanese Yew *Taxus cuspidata*	4	evergreen	very wide	sun, shade		green
	red berries					
Upright Yew *Taxus x media*	4	evergreen	narrow to wide	sun, shade		green
	variety, consult nursery, no clay soils					
American Arborvitae *Thuja occidentalis 'Woodwardii'*	4	evergreen	very wide	sun		green
	globe shape					
Burkwood Viburnum *Viburnum x burkwoodii*	4	deciduous	medium	sun, lt. shade	white, spring	wine, fall
	fragrant, no clay soils					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Snowball Bush *Viburnum opulus 'Roseum'*	4	deciduous *no clay soils, aphids*	very wide	sun, lt. shade	white, spring	red, fall
Leatherleaf Viburnum *Viburnum x rhytidophyllum big textured leaves, no clay soils, protect from winter winds*	4/5	evergreen	very wide	sun, shade	white, spring	green
American Highbush Cranberry *Viburnum trilobum*	4	deciduous *red berries edible, no clay soils*	wide	sun, lt. shade	white, spring	red, fall

HIGH WATER TABLE (no irrigation)

Red Twig Dogwood *Cornus sericea*	see zone 2					
Sandbar Willow *Salix exigua*	4	deciduous *spreads, thickets, fast*	wide	sun		gray, green

SHRUBS UNDER 6 FEET TALL

WATER ZONE 0 (no irrigation)

Observe plants and apply water if wilting or other signs of stress are noticed. Some plants may require more than one year of watering for establishment. These shrubs are very drought tolerant and over watering will kill them.

Big Sagebrush *Artemisia tridentata*	4	evergreen *sage fragrance*	medium	sun	yellow, spring	gray, green
Fourwing Saltbush *Atriplex canescens*	4	deciduous *salt tolerant*	medium	sun	yellow, spring	gray, green
Rubber Rabbitbrush *Chrysothamnus nauseosus*	4	deciduous *can be pruned for rounded shape*	medium	sun	yellow, summer	gray, green
Mormon Tea *Ephedra viridis*	4	evergreen *green stems, no wet soils, no fertilizer*	medium	sun		green
Apache Plume *Fallugia paradoxa*	5	deciduous *persistent purplish plumes, tolerates clay soil*	medium	sun	white, spring	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
New Mexico Privet *Forestiera neomexicana*	5	deciduous	wide	sun	white, spring	grey, green
Dwarf Smooth Sumac *Rhus glabra 'Cismontana'*	4	deciduous	medium *no clay soils, heat and drought tolerant*	sun	white, spring	red, fall
Oakleaf Sumac *Rhus trilobata*	4	deciduous	wide *red berries, drought tolerant*	sun, shade	yellow, summer	orange, fall
Adams Needle Yucca *Yucca filamentosa*	4	evergreen	narrow *doesn't bloom every year*	sun	white, summer	green

WATER ZONE 1 (1 irrigation per month)

Watch shrubs for signs of wilting or other stress and water more frequently if necessary.

Creeping Mahonia *Mahonia repens*	4	evergreen	medium *drought tolerant*	sun, shade	yellow, spring	purplish, fall
Pygmy Pea Shrub *Caragana pygmaea*	4	deciduous	medium *hardy, drought tolerant*	sun	yellow, spring	yellow, fall
Junipers *Juniperus sp*	4	evergreen	medium *great variety, consult nursery, no wet soils*	sun, shade		blue to green
Common Juniper *Juniperus communis 'Uinta'*	4	evergreen	narrow *native, not very heat tolerant, prefers to grow at the base of trees*	sun, shade		green
Dwarf Mugo Pine *Pinus mugo 'Pumilio'*	4	evergreen	narrow *slow*	sun		green
Western Sand Cherry *Prunus besseyi*	4	deciduous	medium *purple fruit, tolerant heat, wind, drought*	sun	white, spring	gray, green
Silver Buffaloberry *Shepherdia argentia*	4	deciduous	medium *small orange fruits, edible*	sun, lt. shade		gray, green
Common Snowberry *Symphoricarpos alba*	4	deciduous	medium *white berries*	shade, sun	pink, summer	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Coralberry *Symphoricarpos x chenaultii*	4	deciduous *purple berries, well drained soils*	narrow	shade, lt.sun	pink, summer	green
Mountain Snowberry *Symphoricarpos oreophilus*	4	deciduous *white berries, drought tolerant*	narrow	shade, lt.sun	pink, summer	green

WATER ZONE 2 (2 irrigations per month)

These plants may need additional water during prolonged hot / dry spells.

Dwarf Balsam Fir *Abies balsamea 'Nana'*	4	evergreen *slow*	narrow	sun, lt. shade		green
Kinnikinnick *Arctostaphylos uva-ursi*	4	evergreen *shrub/ground cover, prefers some acidity*	narrow	lt. shade	pink, spring	green
William Penn Barberry *Berberis x gladwynensis*	5	evergreen *rounded shape, prickly*	narrow	sun	yellow, spring	green
Mentor Barberry *Berberis x mentorensis*	5	deciduous *thorns*	medium	sun, lt. shade	yellow, spring	orange, fall
Japanese Barberry *Berberis thunbergii 'Atropurpurea'*	4	deciduous *red foliage; colors and heights vary, thorns*	medium	sun, lt. shade	yellow, spring	red, fall
Blue Mist Spirea *Caryopteris x clandonensis*	4	deciduous *may need protection in area 4*	medium	sun	blue, summer	yellow, fall
Flowering Quince *Chaenomeles japonica*	4	deciduous *salmon, red, white, purple, may need protection in zone 4, thorns*	narrow	sun	varies, spring	yellow, fall
Cranberry Cotoneaster *Cotoneaster apiculata*	4	deciduous *red berries*	medium	sun	white, spring	red, fall
Bearberry Cotoneaster *Cotoneaster dammeri 'Coral Beauty'*	4	evergreen *red berries*	medium	sun	white, spring	red, winter
Aaron's Beard *Hypericum calycinum*	5	semi-evergreen *spreads, shrub/ground cover*	medium	sun, lt. shade	yellow, summer	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Golden St. Johnswort *Hypericum frondosum*	5	deciduous	medium	sun	yellow, summer	blue, green
Clavey's Dwarf Honeysuckle *Lonicera xylosteum 'Claveyii'*	4	deciduous	medium	sun	white, spring	blue, green
	small rounded shape					
Compact Oregon Grape *Mahonia aquifolium 'Compacta'*	4	evergreen	medium	shade, lt.sun	yellow, spring	bronze, fall
	protect from winter wind and hot sun, spiny					
Mountain Lover *Pachistima myrsinites*	4	evergreen	narrow	shade		green
	ground cover, no clay soils					
Dwarf Double Mockorange, *Philadelphus x virginalis 'Minnesota Nana'*	5	deciduous	narrow	sun, lt. shade	white, summer	green
	fragrant					
Nest Spruce *Picea abies 'Nidiformis'*	4	evergreen	medium	sun		green
	slow					
Potentilla *Potentilla fruiticosa*	4	deciduous	medium	sun, lt. shade	varies, summer	yellow, fall
	red, yellow, white, orange, drought tolerant					
Dwarf Flowering Almond *Prunus glandulosa 'Rosea Plena'*	4	deciduous	narrow	sun	pink, spring	green
Alpine Currant *Ribes alpinum*	4	deciduous	medium	sun, shade	yellow, spring	yellow, fall
	hedge, grouping					
Golden Currant *Ribes aureum*	4	deciduous	medium	sun, shade	yellow, spring	orange, fall
	fragrant					
Austrian Copper Rose *Rosa foetida 'Bicolor'*	4	deciduous	medium	sun	copper, summer	golden, fall
	a wild rose look, beautiful color, drought tolerant, likes reflected heat					
Rocky Mountain Thimbleberry *Rubus deliciosus*	4	deciduous	medium	sun, lt. shade	white, spring	green
	red fruit not palatable, not heat tolerant					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Thimbleberry *Rubus parviflora*	4	deciduous *red edible fruit, not heat tolerant*	medium	sun, lt. shade	white, spring	green
Miss Kim Lilac *Syringa patula* *'Miss Kim'*	4	deciduous	narrow	sun	lavender, summer	green
WATER ZONE 3 (1 irrigation per week)						
Butterfly Bush *Buddleia davidii*	4	deciduous *regrows each spring, pink, purple, blue, white*	medium	sun	varies, summer	green
Petite Butterfly Bush *Buddleia nanhoensis* *'Petite Indigo'* *'Petite Plum'*	4	deciduous *regrows each year*	narrow	sun	varies, summer blue purple	green
Boxwood *Buxus microphylla* *'Green Beauty'* *'Winter Gem'*	5	evergreen *hedge, winter burn, spider mites*	narrow	shade, sun	white, spring	green
Dwarf Boxwood *Buxus sempervirens* *'Suffruticosa'*	5	evergreen *winter burn, spider mites*	narrow	sun, shade	white, spring	green
Isanti Dwarf Dogwood *Cornus sericea* *'Isanti'*	4	deciduous *red stems*	narrow	sun	white, summer	red, fall
Dwarf Kelsey Dogwood *Cornus sericea* *'Kelseyi'*	4	deciduous *rounded shape*	narrow	sun	white, summer	green
Arnold's Dwarf Forsythia *Forsythia 'Arnold's Dwarf'*	4	deciduous	medium	sun, lt. shade	yellow, spring	green
Red Confederate Rose *Hibiscus mutabilis* *'Rubra'*	5	deciduous *no clay soils*	medium	sun	red, summer	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Annabelle Hydrangea *Hydrangea arborescens* *'Annabelle'*	4	deciduous	medium	sun, lt. shade	white, summer	green
	protect in winter, no clay soils					
Nikko Blue Hydrangea *Hydrangea macrophylla* *'Nikko Blue'*	5	deciduous	medium	sun, lt. shade	blue, summer	green
	other varieties white, purple, red; protect in winter, no clay soils					
Dwarf Golden Ninebark *Physocarpus opulifolius* *'Dart's Gold'* *'Nana'*	4	deciduous	narrow	sun, lt. shade	white, spring	yellow
Dwarf Artic Blue Willow *Salix purpurea* *'Nana'*	4	deciduous	medium	sun		blue, green
	requires iron in high pH soils					
Spiraea *Spiraea x bumalda*	4	deciduous	narrow	sun	varies, summer	red to green
	pink, red, white					
English Yew *Taxus baccata* *'Repandens'*	4	evergreen	wide	sun, shade		green
	red berries, no clay soils					
Little Gem Arborvitae *Thuja occidentalis* *'Little Gem'*	4	evergreen	medium	sun		green
Weigela *Weigela florida* *'Java Red'* *'Minuet'*	4	deciduous	narrow	sun	varies, spring red pink	green
	no clay soils					

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME

ANNUALS & PERENNIALS

WATER ZONE 0 (no irrigation)

These plants will survive without irrigation during most years. However, they flower more when watered once or twice per month.

Porters Sulphur Flower *Eriogonum umbellatum 'Porters'*	4	perennial	6↑	sun, lt. shade	yellow, summer	green
California Poppy *Eschscholzia californica*	4	annual *self seed*	8↑	sun	orange, summer	gray, green
Native Blue Flax *Linum lewisii*	4	perennial *invasive, spreads rapidly by seed, native*	18↑	sun	blue, summer	green
Wasatch Penstemon *Penstemon cyananthus*	4	perennial	24↑	sun	blue, summer	green
Penstemon *Penstemon strictus 'Bandera'*	4	perennial *drought tolerant*	24↑	sun	purple, summer	green

WATER ZONE 1 (1 irrigation per month)

These plants are drought tolerant. They should survive with a monthly irrigation but you may choose to irrigate them 2 times per month from June through August for additional flowering.

Fernleaf Yarrow *Achillea filipendula 'Coronation Gold'*	4	perennial *dried arrangements, competitive*	36↑	sun	yellow, summer	green
Common Yarrow *Achillea millefolium* *'Paprika'* *'Roseum'* *'Red Beauty'*	4	perennial *the white species is very invasive*	24↑	sun	white, summer, red pink red	green
Wooly Yarrow *Achillea tomentosa 'King Edward'*	4	perennial *fuzzy, creeping, ground cover*	8↑	sun	yellow, summer	gray, green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Pasque Flower *Anemone pulsatilla*	4	perennial *white or purple*	8↑	sun	spring	green, fuzzy
Coneflower *Echinaceae purpurea* *'Alba'* *'White Swan'*	4	perennial *drought tolerant*	30-	sun	purple, summer white white	green
Perennial Flax *Linum perenne* *'Alba'*	4	perennial *no clay or wet soils*	18↑	sun	blue, spring white	green
Moss Rose *Portulaca grandiflora*	4	annual *good groundcover*	4↑	sun	varies, summer	green
Sedum *Sedum kamtschaticum* *'Variegatum'*	4	perennial *white edged leaves*	8↑	sun, lt. shade	yellow, summer	green
Sedum *Sedum spectabilis* *'Autumn Joy'*	4	perennial	15↑	sun, lt. shade	red, fall	green
Sedum *Sedum spurium* *'Dragon's Blood'* *'Red Carpet'*	4	perennial	4↑	sun, lt. shade	red, summer	bronze, green
Hens and Chicks *Sempervirens tectorum* *'Braunii' or 'Pilioseum'* *'Red Beauty'*	4	perennial	4↑	sun	green, summer red	green

WATER ZONE 2 (2 irrigations per month)

Butterfly Flower *Aesclepias tuberosa*	4	perennial *shrub like*	24↑	sun	orange, summer	green
Bugleweed *Ajuga reptans* *'Bronze Beauty'*	4	perennial	6↑	shade, lt.sun	blue, spring	green or tricolor

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
'Burgundy Glow'						
Hollyhock *Alcea rosea* *'Chatters'* *'Powderpuffs'*	4	perennial	6↑	sun	mixed, summer	green
Rock Cress *Arabis caucasica* *'Snow Cap'*	4	perennial	6↑	sun	white, summer	gray, green
Common Thrift *Armeria maritima* *'Dusseldorf Pride'* *'Splendens'*	4	perennial	8↑	sun	varies, summer red pink	green
Wormwood *Artemisia absinthium* *'Powis Castle'*	4 *no wet soils*	perennial	18↑	sun		grey, green
Wormwood *Artemisia schmidtiana* *'Silver Mound'*	4 *no wet soils*	perennial	10↑	sun		gray, green
Wormwood *Artemisia stelleriana* *'Silver Brocade'*	4 *no wet soils*	perennial	24↑	sun		silver, green
Alpine Aster *Aster alpinum* *'Goliath'*	4	perennial	6↑	sun	blue, summer	green
Hardy Aster *Aster frikartii* *'Monch'*	4	perennial	30↑	sun, lt. shade	purple, fall	green
Michaelmas Daisy *Aster novi-belgii* *'Pro Kippenburg'* *'Snow Cushion'*	4	perennial	15↑	sun, lt. shade	varies, fall red blue, white	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Basket of Gold *Aurinia saxatalis* *'Mountain Gold'*	4	perennial *formerly Alyssum saxatalis*	8↑	sun, lt. shade	yellow, spring	gray, green
Serbian Bellflower *Campanula poscharskana*	4	perennial	6↑	sun	lavender, spring	green
Snow in Summer *Cerastium tomentosum* *'Yo-Yo'*	4	perennial	4↑	sun, shade	white, summer	gray, green
Wallflower *Cheiranthus cheiri* *'Orange Bedder'*	4	perennial *may survive in zone 1*	18↑	sun	orange, summer	green
Threadleaf Coreopsis *Coreopsis verticillata* *'Moonbeam'*	4	perennial	20↑	sun	yellow, summer	green
Yellow Corydalis *Corydalis lutea*	4	perennial *invasive*	10↑	sun, lt. shade	yellow, summer	gray, green
Barrenwort *Epimedium x rubrum* *'Rubrum'* *'Sulphureum'* *'Roseum'*	5	perennial *tolerates dry shade*	9↑	sun, shade	varies, spring, red yellow pink	green
Blue Sea Holly *Eryngium alpinum*	4	perennial *look like blue teasels*	24↑	sun	blue, summer	gray, green
Cushion Flower *Euphorbia epithymoides*	4	perennial *drought tolerant*	12↑	sun	yellow, spring	green
Alpine Strawberry *Fragaria vesca* *'Improved Rugen'*	4	perennial *bear fruit summer*	6↑	sun, shade	white, summer	green
Blanket Flower *Gaillardia x grandiflora* *'Goblin'* *'Dazzler'*	4	perennial *drought tolerant*	8↑ 15↑	sun	red / yel, summer	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Cranesbill *Geranium endressii* *'Johnsons Blue'*	4	perennial	12↑	sun	blue, summer	green
Wild Geranium *Geranium viscossimum*	4	perennial	20↑	lt. shade, sun	rose, summer	green
Daylily *Hemerocallis* hybrids	4 *all colors, tolerates clay soils*	perennial	40↑	sun, lt. shade	varies, summer	green
German Bearded Iris *Iris x germanica*	4 *drought tolerant, possibly zone 1*	perennial	30↑	sun	varies, spring	green
Sweet Iris *Iris pallida*	4 *fragrant*	perennial	30↑	sun	blue, spring	varieg.
Red Hot Poker *Kniphofia uvaria* *'Early Hybrids'*	5	perennial	30↑	sun, lt. shade	red & yellow, summer	green
Primrose *Oenothera missouriensis*	4 *possibly zone 1*	perennial	10↑	sun, shade	yellow, summer	green
Poppy *Papaver nudicaule*	4	perennial	15↑	sun	mix, summer	green
Poppy *Papaver orientale*	4 *pink, orange, red, salmon*	perennial	30↑	sun	varies, summer	green
Penstemon *Penstemon barbatus* *'Elfin Pink'*	4 *also red purple varieties to 20↑*	perennial	12↑	sun	pink, summer	green
Penstemon *Penstemon pinifolius*	4	perennial	8↑	sun	red, summer	green
Creeping Phlox *Phlox stolonifera* *'Blue Ridge'*	4 *also white, pink*	perennial	8↑	sun, shade	varies, spring blue	green
Creeping Phlox *Phlox subulata*	4 *blue, pink, red, white*	perennial	6↑	sun, shade	varies, spring	green

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
Jacobs Ladder	4	perennial	16↑	sun	blue, spring	green
Polemonium caeruleum	*prefers afternoon shade*					
Black Eyed Susan	4	perennial	24↑	sun	yellow, summer	green
Rudbeckia fulgida	*possibly zone 1*					
'Goldstrum'						
Black Eyed Susan	4	perennial	20↑	sun	yellow, summer	green
Rudbeckia hirta	*possibly zone 1*					
'Gloriosa Daisy'						
Golden Rod	4	perennial	30↑	sun, lt. shade	yellow, summer	green
Solidago canadensis						
'Strahlenkrone'						
Lambs Ears	4	perennial	12↑	sun, shade	purple, summer	silver, gray
Stachys byzantia	*soft foliage, no clay soils, zone 1 in shade*					
Sea Lavender	4	perennial	18↑	sun	white, summer	green
Statice tataricum	*dried flower*					
Germander	5	perennial	6↑	sun	red, summer	green
Teucrium chamaedrys						
'Canadense'						
WATER ZONE 3 (1 irrigation per week)						
Maidenhair Fern	4	perennial	12↑	shade, lt.sun		green
Adiantum pedatum						
Snapdragon	4	annual	24↑	sun	varies, summer	green
Antirrhinum majus	*all colors, dwarf 8↑, taller varieties 36↑*					
Columbine	4	perennial	10↑	lt.sun, shade	varies, summer	green
Aquilegia hybrida	*zone 1 or 2 with shade and heavy mulch*					
'Biedermeier'						
'Dynasty'			30↑			
'McKanna'			30↑			
False Spirea	4	perennial	24↑	shade, lt.sun	varies, summer	green
Astilbe x arendsii	*moist soil*					
'Bridal Veil'					white	

NAME	AREA	EVERGREEN / DECIDUOUS	WIDTH	SUN / SHADE	FLOWER, TIME	LEAF, TIME
'Etna'					red	
'Rheinland'					pink	
Goats Beard	4	perennial	36↑	shade, lt.sun	rose, summer	green
Astilbe taquettii *'Superba'*						
Aubrieta	4	perennial	4↑	sun	varies, spring	green
Aubrieta deltoidea	*blue, purple, red, somewhat drought tolerant*					
Non-Stop Begonia	4	annual	8↑	shade, lt. shade	varies, summer	green
Begonia hybrida	*orange, pink, scarlet, yellow, white*					
Wax Begonia	4	annual	6↑	shade, lt. shade	varies, summer	green
Begonia semperflorens	*pink, white, red*					
Saxifraga	4	perennial	12↑	shade	pink, spring	green
Bergenia cordifolia	*protect from afternoon sun*					
Calendula	4	annual		sun	varies, spring	green
Calendula officinalis	*yellow, red*					
Carpathian Harebell	4	perennial	8↑	sun, lt. shade	varies, summer	green
Campanula carpatica	*blue, white*					
Bluebells of Scotland	5	perennial	16↑	sun, lt. shade	blue, fall	green
Campanula rotundifolia *'Olympica'*						
Bachelor's Buttons	4	annual	12↑	sun	varies, summer	gray, green
Centaurea spp.	*red, pink, blue, white*					
Keys of Heaven	4	perennial	30↑	sun, lt. shade	red, summer	green
Centranthus ruber *'Roseus'*	*may bloom all season*					
Shasta Daisy	4	perennial	20↑	sun	white, summer	green
Chrysanthemum maximum *'Alaska'*	*spread*					
Butter Daisy	4	perennial	15↑	sun	yellow, summer	green
Coreopsis grandiflora *'Baby Sun'*	*single flower*					

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
'Sunray'	*double*					
Cosmos	4	annual	36↑	sun	varies, summer	green
Cosmos bipinnatus	*bright colors, airy, variation in height*					
Larkspur	4	perennial	30↑	lt. shade, sun	blue, summer	green
Delphinium elatum						
'Connecticut Yankee'						
Butterfly Delphinium	4	perennial	15↑	lt. shade, sun	blue, summer	green
Delphinium grandiflorum	*protect from wind*					
'Butterfly'						
Hardy Carnation	4	perennial	18↑	sun	varies, summer	gray, green
Dianthus caryophyllus						
Maiden Pinks	4	perennial	4↑	sun	varies, spring	gray, green
Dianthus deltoides						
'Albus'						
'Brilliant'						
Sweet Woodruff	4	perennial	8↑	shade, lt.sun	white, spring	green
Galium odoratum						
Grecian Rose	4	perennial	12↑	sun, lt. shade	orange, spring	green
Geum coccineum						
'Borissi'						
Grecian Rose	4	perennial	24↑	sun, lt. shade	varies, spring	green
Geum quellyon						
'Lady Stratheden'					yellow	
'Mrs.Bradshaw'					red	
Baby's Breath	4	perennial	36↑	sun	white, summer	green
Gypsophila paniculata	*dried arrangements*					
'Bristol Fairy'						
Coral Bells	4	perennial	18↑	shade, sun	red, spring	green
Heuchera sanguinea						
'White Cloud'					white	
'Palace Purple'						red

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
Plantain Lily *Hosta spp.*	4	perennial *gray green foliage to green to variegated*	6"–30"	shade, lt.sun	lavender, summer	varies
Candytuft *Iberis sempervirens*	4	perennial	12"	sun	white, spring	green
Impatiens *Impatiens wallerana*	4	annual *bright colors pastels, taller varieties*	6"	shade, lt.sun	varies, summer	green
English Lavender *Lavandula angustifolia* *'Hidcote Blue'* *'Munstead Strain'*	4	perennial	15"	sun	purple, summer	gray, green
Gayfeather *Liatris spicata* *'Kobold'*	4	perennial	24"	sun	purple, summer	green
Lupine *Lupinus hybrida* *'Russell Hybrids'*	4	perennial	24"–36"	sun, lt. shade	varies, summer	green
Maltese Cross *Lychnis chalcedonica*	4	perennial	20"	sun, lt. shade	red, summer	gray green
Rose Champion *Lychnis coronaria* *'Abbotswood Rose'* *'Angel Blush'*	5	perennial	30"	sun	rose, summer	gray, green
Bee Balm *Monarda didyma*	4	perennial *red, pink, white*	36"	sun, lt. shade	varies, summer	green
Cinnamon Fern *Osmunda cinnamonea*	4	perennial *prefer moisture*	36"	shade, lt.sun		green
Peony *Paeonia hybrida*	4	perennial *red, pink, white, purple, yellow*	36"	sun	varies, spring	green
Russian Sage *Perovskia atriplicifolia* *'Azure Sage'*	5	perennial *spreads, possibly zone 2*	40"	sun	purple, summer	gray, green

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
Balloon Flower	4	perennial	24↑	sun, lt. shade	varies, summer	green
Platycodon grandiflorus						
'Double Blue'					violet	
'Shell Pink'					pink	
Salvia	4	annual	24↑	sun	varies, summer	green
Salvia pratensis	*red, purple*					
Perennial Salvia	4	perennial	18↑	sun	purple, summer	green
Salvia superba						
'East Friesland'						
'May Night'						
Rock Soapwort	4	perennial	8↑	sun, lt. shade	pink, spring	green
Saponaria ocymoides	*can be invasive, can be zone 2*					
Marigolds	4	annual	all	sun	varies, summer	green
Tagetes hybrida	*great variety of colors and heights*					
Thyme	4	perennial	varies	sun	varies, summer	varies
Thymus spp.	*some species zone 2*					
Spiderwort	4	perennial	24↑	sun, lt. shade	varies, summer	green
Tradescantia virginiana	*species is drought tolerant to zone 2 or 1*					
'Pauline'					pink	
'Zwanenberg'					purple	
Speedwell	4	perennial	15↑	sun, lt. shade	varies, summer	green
Veronica hybrida						
'Blue Charm'					blue	
'Icicle'					white	
Sweet Violet	4	perennial	6↑	lt.sun, shade	varies, spring	green
Viola cucullata						
'Freckles'					purple	
'White Czar'					white	
Pansies	4	annual	6↑	sun, lt. shade	varies, summer	green
Viola hybrida	*all colors, bloom spring to winter*					

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 4 (2 irrigations per week)						
Ageratum *Ageratum houstonianum*	4	annual	8↑ *white, blue*	sun, shade	varies, summer	green
Cockscomb *Celosia argentea*	4	annual	24↑ *taller varieties 36↑ shorter varieties 6↑*	sun	varies, summer	green
Clarkia *Clarkia amoena*	4	annual	24↑ *heights and colors vary*	lt. shade, sun	pink, summer	green
Dahlia *Dahlia merckii*	4	annual	24↑ *waxy look, various colors, tubers*	sun, lt. shade	varies, summer	green
Foxglove *Digitalis ambigua*	4	perennial	24↑	lt. shade	yellow, summer	green
Foxglove *Digitalis x mertonensis*	4	perennial	36↑	lt. shade	rose, summer	green
Monkey Flower *Mimulus hybridus*	4	annual	12↑ *like wet soil*	shade, lt. shade	yellow, summer	green
Geranium *Pelargonium spp.*	4	annual	20↑ *red, white, salmon, purple*	sun	varies, summer	green, varieg.
Petunia *Petunia hybrida*	4	annual	12↑ *all colors*	sun	varies, summer	green
Tall Phlox *Phlox paniculata*	4	perennial	24↑ *blue, orange, pink, red, white*	sun, lt. shade	varies, summer	green
Pincushion Flower *Scabiosa atropurpurea*	4	annual	24↑ *white, blue, red, can be zone 3*	sun, lt. shade	varies, summer	green
Zinnia *Zinnia hybrida*	4	annual	all *various colors and heights*	sun	varies, summer	green

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME

GROUND COVERS

WATER ZONE 0 (no irrigation)

These plants may need supplemental irrigation in extremely hot weather. They flower more with additional water.

Porter's Sulphur Flower *Eriogonum umbellatum*	see perennials section			sun	
California Poppy *Eschscholtzia californica*	see annuals section			sun	

These flowers and grasses can be combined, and seeded to grow a low (18") no irrigation ground cover. They will require frequent irrigation for establishment during the first year. Select two or three flowers and one or two grasses. Refer to seedbed preparation and keep seed wet and plants moist for the first season. Flower seeding rates vary, consult the seed company for advice or experiment with 1 pound (#) per acre of each of your flower selections, plus grass.

White Yarrow *Achillea millefolium*	*invasive, flowers more with zone 1 watering*			sun	white, summer
Pacific Aster *Aster chilensis*				sun	lavender, fall
Blue grama *Bouteloua gracilis*	*one grass use 1#/1000 sq. ft., two grasses use 1/2#/1000 sq. ft.*			sun	green, summer
Buffalograss *Buchloe dactyloides*	one grass use 1# / 1000 sq. ft., two grasses 1 / 2# / 1000 sq. ft.,'Sharps'			sun	green, summer
Early Indian Paintbrush *Castilleja chromosa*				sun	red, spring
Sulphur Flower *Eriogonum umbellatum*	*low growing*			sun	yellow, summer
California Poppy *Eschscholtzia californica*				sun	orange, summer
Sheep Fescue *Festuca ovina*	*grass, 1#/1000 sq. ft.*			sun	gray, green
Firewheel *Gaillardia pulchella*				sun	yellow, summer

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
Blue Flax *Linum lewisii*				sun	blue, summer	
Blazing Star *Mentzelia lindleyi*				sun	yellow, spring	
White Evening Primrose *Oenothera pallida*	*for clay soil use O. caespitosa*			sun	white, summer	
Prairie Coneflower *Ratibida columnaris*				sun	yellow, summer	
Showy Goldeneye *Viguiera multiflora*				sun	yellow, summer	

WATER ZONE 1 (1 irrigation per month)

Observe plants for signs of stress and water if needed.

Pink Pussy Toes *Antennaria rosea*	4 *forms dense mat*	evergreen	8↑	sun, lt. shade	pink, summer	silver, gray
Kinnikinnick *Arctostaphylos uva-ursi*	4 *prefers slightly acid soil*	evergreen	6↑	shade, lt.sun	white, summer	green
Creeping Mahonia *Berberis repens*	see low shrubs, evergreen *drought tolerant*			sun, shade		green
Blue Fescue *Festuca ovina 'Glauca'*	4	evergreen	10↑	sun	blue, green	
Common Juniper *Juniperus communis*	see low shrubs			sun, lt. shade		
Juniper *Juniperus horizontalis*	4 *variety, blue green to green, no wet soils*	evergreen	varies	sun, shade		varies
Juniper *Juniperus sabina*	4 *variety, blue green to green, no wet soils*	evergreen	varies	sun, shade		varies
Potentilla *Potentilla verna*	4 *invasive, 'Nana' has mounded form*	deciduous	3↑	sun	yellow, summer	green

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
Dragon's Blood Sedum *Sedum spurium*	see perennials			sun	red, summer	green
Utah Green Sedum *Sedum acre*	4	evergreen *spreads rapidly*	4↑	sun	yellow, summer	green
Hens and Chicks *Sempervirens tectorum*	see perennials *plants multiply but die after they bloom*			sun		green

WATER ZONE 2 (2 irrigations per month)

These plants may need additional water during prolonged dry hot spells.

Bishop's Weed *Aegopodium podagraria*	4	deciduous *prune flowers after blooming, almost zone 1, heat sensitive*	8↑	sun, shade	white, summer	varieg.
Bugleweed *Ajuga reptans*	see perennials			shade, lt.sun		
Basket of Gold *Aurinia saxatilis*	see perennials			sun, lt. shade		
Snow in Summer *Cerastium tomentosum*	see perennials			sun, lt. shade		
Alpine Strawberry *Fragaria vesca*	see perennials			sun, shade		
Aaron's Beard *Hypericum calycinum*	5	evergreen	10↑	sun, shade	yellow, summer	green
Hall's Honeysuckle *Lonicera japonica*	4	deciduous *fragrant, invasive*	10↑	sun, shade	white, summer	green
Dwarf Mountain Lover *Paxistima canbyi*	4/5	evergreen *slightly acid soil preferrable*	10↑	shade, sun		green
Mountain Lover *Paxistima myrsinites*	see low shrubs, evergreen *prefers more acid soil, grows below trees*			shade, lt.sun		green
Memorial Rose *Rosa wichuraiana*	4	semi-evergreen *tolerates poor soil*	12↑	sun	white, summer	green

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE	FLOWER, TIME	LEAF, TIME
WATER ZONE 3 (1 irrigation per week)						
Irish Moss *Arenaria verna*	4	evergreen	1↑	shade, lt.sun		green
Dwarf Plumbago *Ceratostigma plumbaginoides*	4	deciduous	10↑	sun	blue, summer	green
Sweet Woodruff *Galium odoratum*	see perennials			shade, lt.sun		
English Ivy *Hedera helix*	5	evergreen	8↑	sun, shade		green
Creeping Jenny *Lysimachia nummularia*	4 *invasive*	evergreen	3↑	sun, lt. shade	yellow, summer	green
Pachysandra *Pachysandra terminalis*	4	evergreen	8↑	lt.sun, shade	white, summer	green
Wooly Thyme *Thymus lanuginosus*	4 *soft*	evergreen	1↑	sun		gray, green
Periwinkle *Vinca major*	4 *not good for shrub beds, may be zone 2*	deciduous	12↑	sun, shade	blue, summer	green
Periwinkle *Vinca minor*	4 *good for shrub beds, may be zone 2*	deciduous	4↑	sun, shade	blue, summer	green
Sweet Violets *Viola cucullata*	see perennials			sun, shade		

TURF GRASSES

The warm season grasses (zone 1) do not green up as fast as cool season grasses. Successful use of buffalo grass is questioned in zone 4, try a small area first. Water frequently to establish during the first year.

NAME	AREA	GREENS UP TIME	SUN/SHADE
WATER ZONE 1 (1 irrigation per month)			
Blue Grama *Bouteloua gracilis*	4 *seed 1#/1000 sq. ft.*	summer	sun

NAME	AREA	EVERGREEN/ DECIDUOUS	WIDTH	SUN/SHADE
Buffalo Grass	4	summer		sun
Buchloe dactyloides	*seed 3#/1000 sq.ft.*			
WATER ZONE 3 (1 irrigation per week)				
Smooth Brome	4	spring		sun, lt. shade
Bromus inermis	*seed 3#/1000 sq. ft.*			
'Manchar'				
Tall Fescue	4	spring		sun, lt. shade
Festuca arundinaceae	*seed 8#/1000 sq. ft.*			
'Apache', 'Rebel II', or 'Triathalawn'				
Creeping Red Fescue	4	spring		sun, shade
Festuca rubra	*seed 8#/1000 sq. ft.*			
'Pennlawn'				
Canadian Bluegrass	4	spring		sun
Poa compressa	*seed 3#/1000 sq. ft.*			
WATER ZONE 4 (2 irrigations per week)				
Kentucky Bluegrass	4	spring		sun, shade
Poa pratensis	*seed 3#/1000 sq. ft., survives zone 3 watering*			

Figure 27 (far right). Full sun planting of yellow violets, penstemon and big sagebrush.

REFERENCES

NATIVE PLANTS

Landscape Plants from Utah's Mountains, Mountain Plants of Northeastern Utah, Creating Landscapes for Wildlife, Common Native Trees of Utah, and Vascular Plants of Northern Utah.

HORTICULTURE

Manual of Woody Landscape Plants, The Gardener's Companion, Garden Color/Annuals and Perennials, Successful Perennial Gardening, nursery catalogues particularly from local nurseries, *The Best of the Hardiest, Pictorial Guide to Perennials, Perennial Gardens, and Perennials for American Gardens.*

ADDITIONAL PLANTS FOR CONSIDERATION THAT ARE NOT READILY AVAILABLE YET

TREES

Alnus tenuifolia	Thinleaf Alder
Fraxinus anomala	Singleleaf Ash
Malus baccata	Siberian Crabapple
Picea engelmannii	Engelmann Spruce
Picea glauca densata	Black Hills Spruce
Pinus flexilis	Limber Pine

SHRUBS

Amelanchier utahensis	Utah Serviceberry
Artemisia cana	Silver Sage
Brickellia californica	California Brickellbush
Cercocarpus intricatus	Dwarf Mountain Mahogany
Chrysothamnus viscidiflorus	Douglas Rabbitbrush
Cowania mexicana	Cliff Rose
Crataegus crus-galli	Cockspur Hawthorn
Hippophae rhamnoides	Sea Buckthorn
Holodiscus dumosus	Rock Spirea
Jamesia americana	Cliff Jamesia
Mahonia fremontii	Fremont Barberry
Philadelphus lewisii	Idaho Mockorange
Philadelphus microphyllus	Littleleaf Mockorange
Purshia tridentata	Antelope Bitterbrush

FORBS

Artemisia ludoviciana	Prairie Sage
Balsamorhiza sagittata	Arrowleaf Balsamroot
Castilleja spp.	Indian Paintbrush
Eriogonum caespitosum	Mat Buckwheat
Gilia aggregata	Scarlet Gilia
Oenothera pallida	White Evening Primrose
Papaver rhoeas	Shirley Poppy
Penstemon cyananthus	Wasatch Penstemon
Wyethia amplexicaulis	Mule's Ear

Implementing Your Plan

SOIL AMENDMENTS

Most soils benefit from the addition of organic matter such as leaves and grass clippings, composted vegetable scraps, hay, eggshells and coffee grinds. These materials increase air space and provide food for soil microorganisms that release nutrients for plants. At least 3" of composted organic matter should be turned into the soil and mixed to a depth of 12" before planting or mulching. Nitrogen should be added to organic matter or compost before blending it with soil. Rotted manure or another nitrogen fertilizer will do. Your soil test results will indicate how much and what type of fertilizer to add based on plant types. You will find additional information in The Utah Fertilizer Guide. Refer to the soil section for the soil test address and information.

Nitrogen (N), phosphorus (P) and iron (Fe as FeEDDHA) are commonly recommended for Utah soils. Do not waste money on iron sulfate or other iron chelates. FeEDDHA, sold as Fe 138, is the iron supplement to use. It is expensive and prices vary. Gypsum also should not be used for most Utah soils. If you want to acidify a small area of soil, try sulfur or cottonseed meal.

Heavily compacted subsoil is commonly found around new houses. The topsoil layer has often been removed and equipment may have crushed the soil structure. A rototiller, lots of compost and 6" of topsoil may be the solution. If the soil is brick hard, wet it down and let it dry for a day or two, until it is just damp; then you will be able to get the shovel and rototiller into the ground. If you have an impervious hardpan layer or if you are unable to break up the subsoil compaction with a rototiller, have it plowed or ripped before treating the surface soil. Thoroughly mix in 6" of topsoil and 3" of compost with the upper 12" of soil. Soil should not be worked when it is wet to avoid damage to the soil structure.

There are many recent books available on composting. The Encyclopedia of Organic Gardening has a concise informative section on composting.

MULCH

Mulch is valuable for controlling weeds and conserving moisture (Figure 29). Suitable organic mulches include grass clippings, leaves, newspaper, straw or hay (as weed free as possible),

wood chips, or shredded bark. Before applying a mulch, remove unwanted debris and weeds, amend the soil, and water thoroughly. Replenish mulch periodically to maintain a 3" cover; use 2" around ground covers (Figure 28).

Plants that are intolerant of dampness such as penstemons and other native perennials will die if mulch is too close to the base of the plant. For these plants, apply mulch over most of the soil surface, to within 6" of the plants.

Decomposed bark mulch is preferable for new annual gardens. After the plants have died back at the end of the season, the mulch can be turned into the soil with a light application of nitrogen to improve the soil. New mulch must be added to the surface of the soil in the spring.

Inorganic mulches are also effective and include: gravel and stone. A woven landscape fabric installed beneath mulch will provide additional weed control while allowing water to penetrate.

Do not use black polyethylene plastic as a base mulch. It disintegrates in a few years resulting in wings of black plastic flapping in the wind through your mulch. It also does not allow the soil to breath or absorb water. Plastic can girdle trees and cause fungus problems that eventually kill trees and shrubs.

There is a movement to curtail the use of peat moss as a soil amendment or mulch because the harvesting of peat moss is destroying important northern environments.

Figure 28 (left). Shredded wood mulch used in a zone 2 planting bed.

References

The Postage Stamp Garden, Water-wise Gardening, The Utah Fertilizer Guide, and The Encyclopedia of Organic Gardening.

IRRIGATION

Irrigation is a vanishing luxury. Cities have already imposed irrigation water restrictions in drier regions. With the expansion in population and the increasing demand for water, it is likely that more cities and towns will reduce or prohibit landscape irrigation.

Carefully planned irrigation is an important part of landscape design because it helps conserve water. Here are several methods of improving irrigation efficiency:

- Take time to look at the soil. Water when it is dry with only enough water to wet the root zone.
- Turn off the water when enough water has been applied.

- Irrigate during early morning hours to reduce water loss due to evaporation.
- Remove weeds and apply mulch to keep water in the soil for desirable plants.
- Group plants with similar water needs into water zones and irrigate for their requirements.
- Irrigate after a rainfall of an inch or less to help push water deeper into the root zone to encourage deep rooting.
- Aerate turf to increase infiltration.

Irrigation systems must be designed for specific soils and site conditions. Soil characteristics are important in determining rate and frequency of application and in selection of a suitable method of irrigation.

A variety of irrigation systems are available including hose and sprinklers, permanent sprinklers and drip systems. Cost, convenience and water efficiency of systems influence purchasing decisions. Any of these systems can be used successfully but they must be designed and managed to apply water for plant needs at a suitable rate for the soil. Sprinklers should be located and sized to apply water only where it is needed. Irrigation design references are listed below under "Designing Your System."

Water requirements of plants will be greater during the first year of plant establishment, until the root systems are developed. Then watering can be reduced to the water zone recommendations. It is still advisable to check the soil moisture and to observe plant conditions. The objective is to irrigate before plants wilt with only the amount of water necessary to keep them healthy.

The irrigation frequencies or water zones recommended here are based on an unpublished data base entitled *DROUGHT* which lists plants and their range of water requirements, references included in the bibliography, and observations and experiences of local gardeners and / or native plants enthusiasts.

The watering zone schedule is based on well drained loam soils. If you have a sandy soil it may be necessary to irrigate more frequently than the zone suggests. Clay and clay loam soils may require less frequent irrigation for some plants. The soil and the plants are the true indicators; check both regularly.

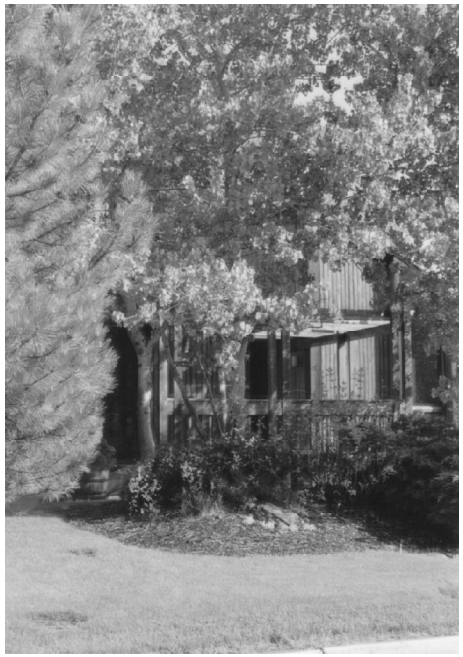


Figure 29 (right center). Wood mulch controls weeds and conserves moisture.

WHEN TO IRRIGATE

It is good practice to begin the irrigation season by thoroughly watering the root zone. An irrigation method should then be selected for determining when to irrigate. There are several methods and you may decide to combine ideas to develop a procedure that suits you.

1. CHECK THE SOIL

Checking the soil to a depth of 12" with a soil probe, or shovel, once or twice a week is a good method of determining when to irrigate. If the soil is barely moist, irrigate.

2. WATER ZONES

The plant water zone guide in the plant section recommends watering frequency.

It is most successfully used with soil checking.

3. INDICATOR PLANTS

Drought sensitive "indicator plants" will wilt when the root zone begins to dry out. Identify these plants in your landscape and irrigate when they begin to wilt.

L O G A N	April	May	June	July	August	Sept.
ETr	4.36	6.07	7.02	7.19	6.86	3.99
ETo	3.63	5.06	5.85	5.99	5.72	3.33
PRECIP.	2.59	1.99	0.82	2.16	0.57	5.76
EF.PREC.	2.07	1.59	0.66	1.73	0.46	4.61
DIFFER.	-1.56	-3.47	-5.19	-4.26	-5.26	+1.28

Table 2 (left). Monthly precipitation, effective precipitation and reference evapotranspiration (ETr)(ETo) in inches, 1982.

4. FEEL THE SOIL

The soil "feel method" is used to determine soil moisture by feeling the soil. By squeezing a handful of soil it is apparent if sandy or loamy soils are dry because they run between the fingers. Clay is hard to break apart when it is dry. When it is time to irrigate, sandy soils still look dry and will not quite form a ball when you squeeze them; loamy and clayey soils will form a loose ball. When adequate water has been applied, you cannot wring water out of the soils. But when you squeeze them they will form a ball and water will be left on your hand. Combining this feel method with the plant water zone recommendations for timing irrigation will give you a good guide.

5. EVAPOTRANSPIRATION

The "ET" (evapotranspiration) method is very important. Once the soil profile has been thoroughly watered in the spring, the objective is to determine the daily amount of water that evaporates and the amount that is used by specific plants (transpiration), this is the ET (evapotranspiration rate). With this information, an accurate determination can be made about when and how much to irrigate plants in a given soil. The following table shows the monthly evapo-transpiration versus the precipitation for the year of 1982. The difference between the two is the amount of water that should be replenished to keep the soil moist for alfalfa. This is converted below for landscape plants.

Unfortunately the daily reference data needed to determine ET for landscape plants are not presently broadcast or printed in the newspapers in Utah, but hopefully it soon will be. To date, local ET data are only collected for alfalfa, in northern Utah. Data are available from the Cooperative Extension Service. This information is adjusted below to estimate landscape water needs.

The difference between the ETr (reference ET for alfalfa) and the ETo (reference ET for grass) is approximately 1.2. ETo, the grass reference ET, is what we want for landscape use. The next variable is rainfall and we will use 80% of the total precipitation as the useable precipitation (EF.PREC.). The difference between the ETo and the EF.PREC. is the amount of water that should be replaced, per month, for Kentucky bluegrass. Divide this number by 8 irrigations per month (twice per week) and you will know what was applied per irrigation. But, looking back only gives us indications, and because each year is different, you will need daily ETo amounts to know how much water to apply to the grass.

Let's use an example for your existing Kentucky bluegrass lawn. When the daily ETo for grass is broadcast as .20", .15", and .20"; you will need to replace .20"+.15"+.20"=.55" of water at the end of those 3 days. Now if it rained .20", we can only count on .20" x .08 = .16"). So, .55" are needed - .16" of rain = .39" that you will provide by irrigating. To effectively apply 0.39" of water will require a knowledge of the application rate (inches / min) of the irrigation system. This can be done by catching and measuring irrigation water over a known time period.

Now the ETo and the EF.PREC. will be used to calculate the amount of water to apply to the rest of the landscape. We will use the same method as above and add a landscape factor (KL), from Costello et al. (1991).

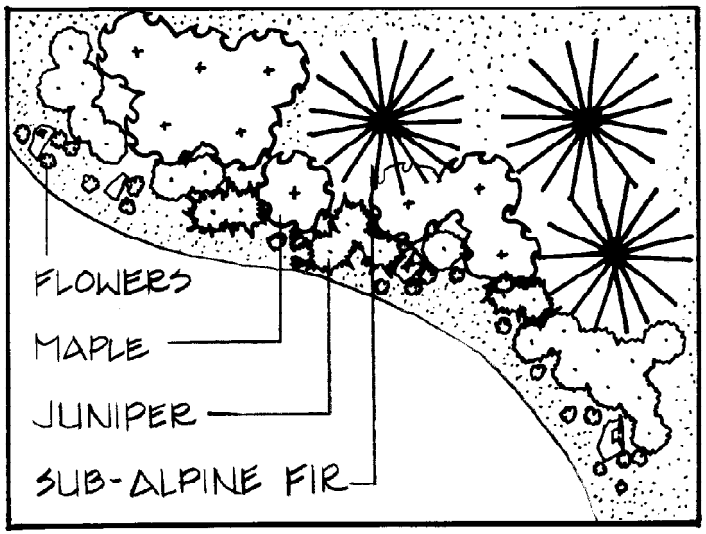


Figure 30 (right). A typical planting bed with trees, shrubs and ground cover.

LANDSCAPE FACTOR (KL) = Ks x Kd x Kmc

Ks adjusts for species (combination of high to low water use trees, shrubs and ground covers):

0.9 = high water use (Zone 3-4) plants

0.5 = moderate water use (Zone 2) plants

0.2 = low water use (Zone 0-1) plants

Kd adjusts for density (canopy and spacing):

1.3 = heavy canopy cover and dense planting

1.1 = average canopy and plant spacing

0.6 = small canopy cover and wide spacing between plants

Kmc adjusts for microclimate:

1.4 = where there are hot reflective surfaces nearby or windy conditions

1.0 = buildings, structures or pavement do not effect the microclimate

0.5 = plants are protected from wind and are in shade part of the day

This is easy to apply. Let's assume we have low water use plants (0.2), small canopy cover and wide spacing (0.6), and an average microclimate (1.0).

0.2 x 0.6 x 1.0 = .12 = KL the landscape factor

As an example from Table 2 we know -3.47" of water needed was for May. Multiply that times the landscape factor, (3.47" x .12 = 0.42") gives the adjusted ET for May, call it ETL for the landscape ET.

If you are interested in calculating all of this more precisely, the entire table of factors, separated by vegetation types, is included on table 3, from Costello et al. (1991) reprinted with permission.

Irrigation applications can be fine tuned by adjusting for the efficiency of the system. Efficiencies and other scheduling

Vegetation type	Species factor (k_s) high	ave*	low	Density factor (k_d) high	ave*	low	Microclimate factor (k_{mc}) high	ave*	low
Trees	0.9	0.5	0.2	1.3	1.0	0.5	1.4	1.0	0.5
Shrubs	0.7	0.5	0.2	1.1	1.0	0.5	1.3	1.0	0.5
Groundcovers	0.7	0.5	0.2	1.1	1.0	0.5	1.2	1.0	0.5
Mixed: trees, shrubs groundcovers	0.9	0.5	0.2	1.3	1.1	0.6	1.4	1.0	0.5
Turfgrass	0.8	0.7	0.6	1.0	1.0	0.6	1.2	1.0	0.8

* average.

Table 3 (far left). Landscape coefficients for determining irrigation requirements.

information can be obtained from a landscape irrigation designer.

Differences between total irrigation requirements for trees, shrubs and perennials within the same zone can be compensated for by the flow rate of the spray emitters, the number of drip emitters, or the length of time you leave the hose in one spot.

IRRIGATION RATE

The rate at which irrigation water should be applied is dependent on the soil intake rate and the irrigation system application rate. They need to match. Sandy soils absorb water at a variable rate, but approximately 2" per hour, loams 3/4" per hour, and clays are the slowest 1/2" per hour.

As an example, lets assume that the ET or your required water amount for the week was 2", and there was no precipitation. The site has loamy soils with a water intake rate of 3/4" per hour. Therefore, it will take (2" ÷ 3/4" / hr = 2 ÷ .75 = 2.67 hrs) 2 hours and 40 minutes to absorb 2" of water. A small additional amount should be added to compensate for the irrigation system inefficiency (100% - 80% = 20%), (20% of 2" = .4" divided by 3/4" per hour=.53 hours or 32 minutes). Total irrigation time is 3 hours and 12 minutes based on the soil intake rate.

The rate of water application for the irrigation system may alter the time. It can't shorten the time because the soil can't take up the water any faster, but it can increase the time. Some sprinklers will apply water too fast; try to find a sprinkler to match your soil intake rate. The can test on page 77 will indicate if the sprinkler is suitable for your soil.

DESIGNING YOUR SYSTEM

Note that a permit is required from the city planning department prior to installing an irrigation system. Several good sources of information are available on irrigation equipment and designing irrigation systems: *Water-wise Gardening, Time Saver Standards for Landscape Architecture* and information and design brochures from suppliers such as Toro, Rainbird or Hardie. Local irrigation and plumbing supply stores, and the Irrigation Association, will also have information, and may be willing to assist with your design.

Irrigation controllers are a key to water management with permanent systems. Controllers activate control valves to turn

on water for a specified period at a given time. A controller that can irrigate slowly for hours is usually preferable to one that has only short cycles. A water budget feature that allows easy seasonal rate adjustment, multiple programs for irrigation zoning and multiple start / stop options is important. Precipitation sensors are becoming more dependable, and they are valuable because they shut off the irrigation system if it is raining to prevent runoff and water waste.

CHECKING YOUR SYSTEM

The can test measures the amount of water actually applied by sprinklers. Space 4 straight sided cans of 3" - 6" diameter, such as clean soup or coffee cans, under your sprinkler. Turn on the water for 15 minutes. Turn it off and measure the depth of water in each can. Add the amounts to get one total and divide by the number of containers (4). Then multiply this total by 4 to get inches per hour (4 x 15 minutes = 1 hour). The rate should be equal to or less than your soil intake rate. (The can test is often used for monitoring bluegrass turf irrigation. The general rule is to apply 1.5"- 2" of water per week during June, July and August, and 1" per week during spring and early fall.)

REFERENCES:

Water-wise Gardening, Lawn Sprinklers: A Do-It-Yourself Guide, Time-Saver Standards for Landscape Architecture.

LANDSCAPE INSTALLATION

There are many sources of information on installing a landscape; references are listed within the section to provide guidance. A summary of steps is provided here, with information that is pertinent to installing a low water landscape.

A SUMMARY OF STEPS:

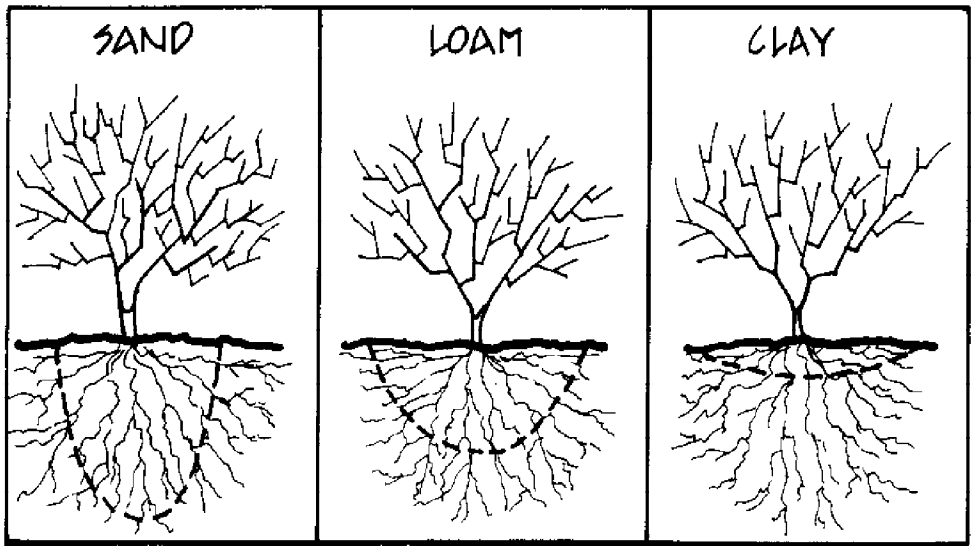


Figure 31. Comparative soil intake rates of sand, loam, and clay.

CHECK LOCAL REGULATIONS before starting. There are specific setbacks for yards, fences, walls and solar access. Mark your utility lines before any work is started and check on local grading ordinances and permit requirements for construction. Contact the Planning and Zoning Department for a copy of the land use ordinances. If there is vegetation that you hope to protect while large equipment is on the site, rope off the area to be protected.

COSTS

Once your landscape is designed, it is important to look at a realistic cost estimate. A list of factors for consideration in preparing a cost estimate is included in the Appendices. Next to each factor is a column for quantity, unit price and total. Detailing each section of this list will help you approach an accurate estimate. The following figures provide a current price range that may assist you with your cost estimate.

- Grass Seeding 60-70 cents / sq. ft.
  including seed, finish grading and topsoil
- Irrigation System 30-50 cents / sq. ft.
- Seedbed Preparation 10-15 cents / sq. ft.
  including soil preparation with soil amendments

Planting trees, shrubs and ground cover:

- shrubs planted 5' on center (o.c.) .90-$1.10 / sq. ft.
  trees 20'+ o.c., ground cover 18" o.c.
- Tree Planting 30-50 cents / sq. ft.
  2" caliper, one per 500 sq. ft.
- Planting Wildflower Carpet $5.00 / sq. ft.
  including soil preparation and sod
- Mulch $325 / yd^3
  1 cubic yard covers 108 sq. ft. 3" deep
- Stone set in sand $8-9.00 / sq. ft.
- Stone set in concrete $10-12.00 / sq. ft.
- Brick set in sand $4-6.00 / sq. ft.
- Brick set in concrete $5-7.00 / sq. ft.
- Concrete $1.50-2 / sq. ft.
  formed, poured and finished

You can see that it is costly to have hard surfaces installed. If you install the materials yourself, the costs will often be 50-75% less. You can compare costs by checking current prices for materials and multiplying those unit costs by the size of your project area.

PHASING CONSTRUCTION

Phasing is a process of dividing a project into sections with planned completion dates. This makes jobs more manageable and affordable than working with the entire project at once.

Phasing is often necessary due to:

- costs
- time required to complete an entire project
- order time for materials
- time of year for planting
- scheduling with contractors

Your decision on how to phase construction will be dependent on factors that effect your project and your priorities. Some materials will only be available at a certain time. Plant materials should be planted at the times specified in this section under planting; usually spring or fall. This requires planning and scheduling for site clean up and soil preparation prior to planting.

Consider the amount of time you will have available to install a landscape. It may be most practical to do some of the work yourself, and to hire professionals to do portions such as: tree planting, irrigation installation, or patio and deck construction. Be prepared for construction projects to take longer than planned.

If cost is the determining factor, cost estimate your landscape by "use areas." With the costs you can prioritize landscape areas for installation. Then look at water zones and plant materials. Understand how the irrigation system (hose and

sprinkler or permanent system) will be installed or retrofitted as part of your phasing. Permanent irrigation systems are usually installed in one phase. If a system is too expensive to include in a particular phase, it can be added later. If heavy equipment must be used, think about access to the area where it is needed. Consider completing phases that require such equipment first so that new installations are not disturbed.

PHASING EXAMPLE

Let's examine phasing for a 1/4 acre lot. The primary objective is to clean up the backyard and reduce water use. The second priority is to add trees to the perimeter of the yard for privacy; and the third priority is to replace the bluegrass turf in the front yard with turf that requires less mowing and water.

The first priority may be handled by scheduling clearing and grading. Unwanted plants are removed first and existing turf is removed with a sod cutter; by shoveling it out and turning it over and shaking the soil loose; or by applying an herbicide such as Roundup (don't allow spray to touch other plants, see directions).

The soils in the planting beds should be tested and amended with 3" of composted organic matter and fertilizer if needed. Because it is easier to plant big plant materials before smaller shrubs and ground covers, it would be preferable to also address the second priority of tree planting, at least in the area where other plants will be added. Quality trees should be selected from reputable nurseries prior to planting time. Planting holes should be prepared for planting and trees should be watered immediately after planting.

A woven landscape fabric could be installed at this stage for weed control. Small trees, shrubs, perennials, annuals and groundcovers would be planted next. Permanent irrigation would then be installed with 3" of mulch applied to the planting beds.

Existing plants in the water zone where the work occurs will require temporary irrigation while work progresses. Too often plants are neglected and die during the conversion; give existing plants extra care during this process.

The final phase involves removing sod, explained in "site clearing" below, and seeding. Timing is critical for establishment of seed to take advantage of soil moisture. The procedure is explained under "planting and seeding." Late fall or spring are the most common seeding times. Seedbeds must be free of rocks and soil clods and improved with organic matter. Seeds should be raked into the soil and a mulch should then be applied. You can see that careful planning is required to install a landscape successfully.

Water-Saving Gardening has an excellent two page description of a phased conversion process and *Landscape Renovation* may be helpful also.

INSTALLATION PROCEDURES

Site Clearing of Debris and Unwanted Plant Material

Site clearing involves removal of unwanted or unsightly materials. The unwanted plant material may be a diseased tree that is choking out other desirable plants or a plant that is in the wrong water zone (transplant it if possible), or turf that needs to be taken out so more water conserving plants can be planted.

Removing unwanted turf can be done several ways. Here are two recommendations. Stretch out the garden hose, or use stakes and string to outline the area where you intend to remove turf. Rent a sod cutter to cut the grass; then shake as much soil from the roots as possible (that's your topsoil) before disposing of the grass. If you have a weed infestation and you plan to convert this area to wildflowers and water conserving turf, after the original turf is removed, take time to rough up the area with a rototiller, water for two weeks, dig out or spray the weeds, and repeat this process a second time. Weeds will still persist, and it will be important to dig them out or spot spray them as they emerge. Because weeds and wildflowers are eradicated by the same herbicides, you want to be rid of the weed infestation before planting wildflowers. Continue to repeat the spot treatment until the weeds are under control.

Another method of removing turf is to spray the turf with an herbicide such as Roundup. If the turf is sprayed in the fall while the grass is still actively growing, and it is left undisturbed over the winter, the grass will be mostly decomposed by spring. The soil can then be tilled, raked and amended for seeding.

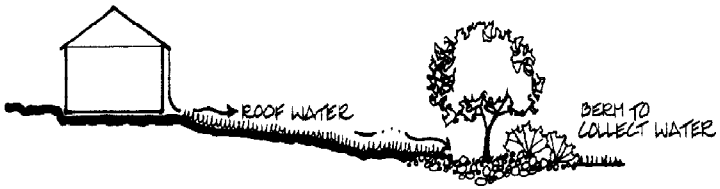
Valuable mulches of old leaves and small twigs should not be considered debris. They should be left because of their importance to the survival of some plants, particularly native species. Also consider leaving a dead tree for raptors and nesting birds, but be sure that the tree is not a safety hazard. Dense brushy under-growth should be left for small birds and animals. Whenever possible, incorporate existing plant materials into your design.

Transplanting plants from one part of your yard to another is difficult. Trees larger than 2" diameter at breast height (DBH) should be moved with heavy equipment. Trees with a DBH of 1 1/2" or larger should have the roots cut the year before the trees will be moved. Cut the roots in a circle with a diameter 10 to 12 times the diameter of the tree trunk at breast height. The depth of the cut should be 75% of the width of the diameter. After cutting the roots, backfill with sandy soil. Cutting the primary roots allows the tree to grow more fibrous roots that will help it to become established when it is moved to its new site. Transplanting should be done when a tree is dormant. Wet the root zone thoroughly, then allow it to dry for a few days so it is just moist, not wet, and work a shovel in a circle around an area 10 to 12 times the DBH. A 1" DBH tree will have a root ball with a diameter of at least 10" to 12". The hole you dig must be larger than the 12" to get enough of the roots. Once you finally have the plant free, carefully slide a tarp under it and wrap the root ball while you move it to it's new place. Refer to "planting large trees" for planting information and see Figure 35.

Rough Grading

Rough grading is used to bring ground elevations to approximately where they meet your requirements for drainage, screening and aesthetics. Rough grade elevations are often 6" to 10" below finished grade, allowing for 6" of topsoil and 3" of mulch.

Figure 33 (right). Directing roof water to plant basins



A small bulldozer or front end loader is usually used for moving large quantities of soil, and the detailed finishing work is completed with a shovel, rake and wheelbarrow.

When creating new topography, create positive drainage away from your house, with a 2% minimum grade. It is illegal to redirect drainage water problems onto another property, and new grading must meet existing grades on adjacent properties. Roof water should be directed to a stabilized outlet of rock or sod, and then to plant basins. Tree wells should be built around root systems where more than 6" of cut or fill will occur within the root zone.

Subsurface Drainage and Underground Utilities

If your soil is heavy clay, consider installing 3-4" diameter perforated polyvinyl chloride (PVC) pipe on a 2-4% slope, in a gravel bed next to structures. This will remove standing water and improve soil drainage. If you have enough elevation change on the property, outlet the water where you can use it such as in tree basins or on turf areas.

Utility lines for 120 volt electricity require site inspection by the city and installation by a licensed contractor.

Amending Soils

Amend soils in planting areas with 3" or more of rich organic matter such as compost and well decomposed manure and mix it well with the top 12-18" of soil. Refer to the section on soil amendments.

Final Grading

Final grading is the process of smoothing out the bumps after all the major earth work is done and the soil is amended. If you are preparing a seedbed for turf, the surface should be free of clods and rocks and it should be raked until it is fine and smooth.

Walls and Walkways

Walls, walkways, paving, patios, fences, and decks should be installed next. If you are doing this work yourself, be sure to read and learn about the process before starting. Often compacting the soil is required before a base material can be laid. It is important to properly prepare the base so that expensive surface materials will not crack and heave (Figure 34).

There are beautiful materials available and using good qual-

Figure 34 (far right). A brick patio with ground cover and shrubs.

ity will enhance your enjoyment of these areas for a long time. Refer to *Nature's Design*, *Step by Step Landscaping* and *All About Landscaping* for installation details. If you can't afford good materials initially, mulch the areas or grow annual plants there until you can afford to do it right.

Permanent Irrigation Systems

Permanent irrigation systems can contribute to good water management if they are designed and installed to provide even water distribution at an acceptable rate for the appropriate length of time. It is important to install sprinkler heads at the right elevation so you can mow over them. If they are on risers, install them in a mulched bed so a weed eater isn't needed to cut vegetation around them. Invest in a controller with multiple program options to accommodate your water zones. For more information refer to Hometime Video *Underground Sprinklers* or *Lawn Sprinklers, A Do-It-Yourself Guide*.

Planting Large Trees

Plant large trees before amending the surrounding soil if heavy equipment must be used. Often it is necessary to plant large trees before the irrigation system is installed to avoid damage to the system. If possible, have the planting holes ready when you buy trees and water the holes a day or two before planting. If you need to store trees prior to planting, keep them damp and well mulched in a partially shaded place.

Plant deciduous trees and shrubs while they are still dormant, in late fall or early spring. This applies to bare root, and balled and burlapped (B&B) stock. This is also a preferable time to plant container grown stock, although it can be planted throughout the season. Evergreen trees and shrubs have been reported to have the best chance of survival when planted in mid spring or early fall. The benefit of planting in the spring is that the plant has an entire season to establish its root system before winter. Summer planting is difficult and often not successful because the plant is putting its energy into foliage and the root system isn't established enough to provide sufficient water for growth.

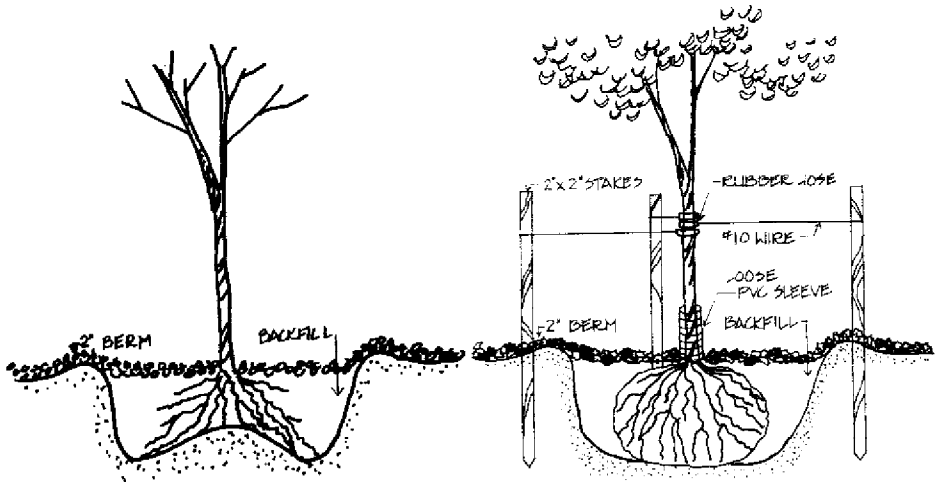


Figure 35. (far left) bare root planting detail. Balled and burlap tree planting detail (right).

There are many diagrams available on how to plant a tree, and the method changes periodically. The current practice is to dig a hole two to three times as wide as the root ball and deep enough for the soil to reach the original soil line on the tree when the hole is backfilled. The tree is then set in the hole on original soil, not disturbed soil, and soil is added around the root ball

(Figure 35). Containers must be removed, and as much burlap as possible, before backfilling, taking care not to break apart the root ball. Bare root trees need the support of a mound of soil in the middle of the hole, and a place to spread roots around the planting hole (Figure 35).

If you amend soil for a tree, be sure it is amended and mixed well in a large area surrounding the tree, not just in the hole. Roots of trees will tend to stay in amended soils and not venture out into the "real soil," so it is controversial about whether or not to amend the soil at all. Flip a coin, but amend it all or none of it. For mountain and other acid loving plants, apply cottonseed meal on the surface and water it into the soil. Cottonseed meal is an organic fertilizer with approximately 7% nitrogen, 2% phosphorus and 1% potassium.

Establishing a well with a 2" berm of soil around a tree makes watering easier initially, but that is where the majority of roots will grow. It is important to water beyond the drip line of the tree canopy to encourage the roots to spread and provide more support for the tree. The soil profile should be thoroughly soaked after planting. The root zone of water zone 2-4 plants and all evergreens, should also be soaked prior to freezing winter temperatures. Zone 0-1 plants should not have late season soaking or fertilizer, because these may cause late growth which may not harden off before winter.

Tree staking may be necessary to stabilize newly planted trees (Figure 35). Drive two 6-foot-long stakes into the ground positioned so that an imaginary line connecting them would be at a right angle to the direction of strong winds. Hold the trunk of the tree in one hand and push the top of the tree to one side, where you see the tree bend is where the ties need to be to support the tree. Refer to the manual entitled *Urban and Community Forestry* for more information. Remove stakes and ties at the end of the growing season. A loose sleeve of slit corrugated polythylene pipe slipped around the base of trees will protect them from mower and rodent damage. Spring tree wrapping to prevent sun scalding and bark cracking is under question because of fungus problems. Experts are not all convinced of its value.

The following are helpful references: *Urban and Community Forestry* and *Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines.*

Planting, Seeding, Fertilizing, and Mulching

There is much to learn about successful establishment of native plants by looking at natural plant associations. It is apparent that Gambel oaks grow in clusters where the new seedlings get a start in a natural ground cover of leaf litter, and quaking aspens grow from suckers that flourish in damp soil where grasses, wild geraniums and columbines grow. Jim Morris, from Newton, Utah, only waters the columbines in his natural landscape once a month and he has noticed that the naturally reseeded plants are now growing on the northeast side of that zone to take advantage of the shade and subsequently moister soil. Allowing successional processes to occur is inherent in establishing "native" landscapes.

To establish native or introduced drought tolerant plants, recreate the indigenous habitat for the plants in as much detail as possible. If your lot is along the foothills, the soil is probably ready for sagebrush, rabbitbrush, penstemons and yellow mule's ears. If you plan to buy and plant mountain plants such as firs, spruce, mountain lover and kinnikinnick, amend the soil with organic matter and add cottonseed meal for acidity and nutrition.

Because it is difficult to establish some native and drought tolerant plants, you may have the best success by planting smaller stock: tubelings to 5 gallon size. Small plants can grow an extensive root system before sprouting larger top growth.

Other introduced plants can be successfully planted in a variety of sizes, providing they are planted properly and at the correct time of the year. Shrubs, perennials and annuals are most successfully planted in the spring to allow the growing season for establishment, but because they are container grown, they can be planted from spring to fall.

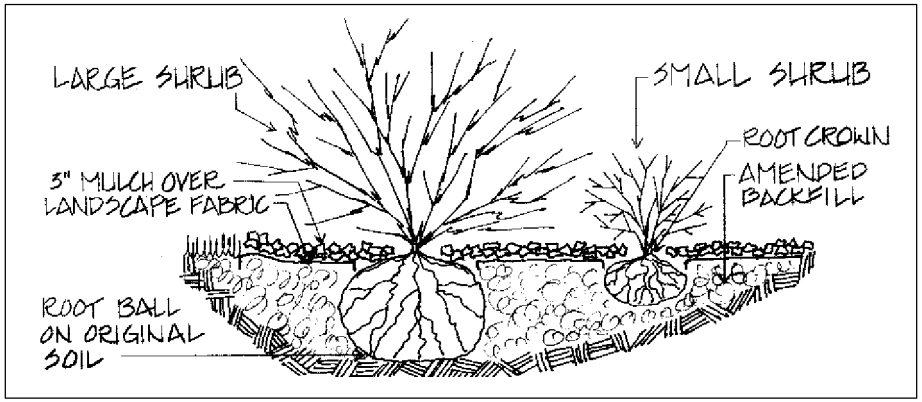


Figure 36 (far left) Detail of shrub planting.

If woven landscape fabric is to be used for weed control, install it according to the directions supplied prior to planting shrubs and small plants. A cross shaped cut should be made and the fabric should be folded under to make room for each plant.

Large shrubs should be planted in the same manner as a tree is planted (Figure 35). Smaller shrubs can be planted in loose soils and the depth of the planting hole should adjusted so that backfill will meet the root crown or the original soil line (Figure 36). If amended backfill is used, amend the soil in the surrounding area so the roots don't stay bound in the little planting hole.

Annuals should be planted as soon as the average frost free day rolls around, May 1 for the Salt Lake area, and May 15 for Cache Valley. You can plant earlier if you don't mind the risk. Annuals have to complete their life cycle to produce seed for the next year. If you are expecting them to reseed, plant them early in the spring. Because some will not produce viable seed, they must be replanted the following year. Fertilize annuals with 10-10-10 during the summer. If the soil was not amended prior to planting, fertilizer should also be added soon after planting.

To plant annuals and perennials, dig holes deep enough so the roots will be covered with soil, just to the root crown. Plant during morning or evening if possible and water as you go. If it is a particularly hot sunny day, delicate plants will have a better chance of survival if they are shaded for a few days by a shingle stuck in the ground. Plants that have not been growing outside in full sun should be hardened off, a process of storing them in light shade, and increasing sun exposure for 3 or 4 days before planting. If it is hot, watering may be necessary every day or every other day until the roots get established. Helpful references on planting include *Complete Guide to Gardening*, and *Garden Color*.

Annual spring and occasional fall fertilizing with 10-10-10 is advised for many perennials. Most drought tolerant plants do not require much fertilizer, usually one application after planting is enough. Watch these plants for signs of deficiencies and apply a very light application of 10-10-10 fertilizer when needed. Some perennials will require dividing to survive and others require "neglect" (see page 104). Refer to these references for specific plant information: *Perennial Gardens, Successful Perennial*

Gardening and Complete Guide to Gardening.

Sizes of plants to select for planting will depend on your budget and the appearance you want. Low budget plantings often include bare root and 1-5 gallon trees and shrubs with a few 5-6' or 1" caliper (trunk diameter 1' off the ground) trees. Two inch caliper trees help a landscape to look mature. High budget plantings may include planting 20' trees, with 5' shrubs and specially grown annuals and perennials. A variety of sizes should be used for interest and long term enjoyment of the landscape.

Cool season grasses and wildflowers may be seeded during late fall or early spring. The risk associated with fall seeding is that there may not be enough winter moisture to prevent the seed from drying out. If there is enough moisture, the seed has a head start in the spring. Planting should only be done when the soil is moist, but not wet. The only assurance of spring moisture is irrigation, and it takes daily watering to establish seed. Warm season grasses are the most drought tolerant and should only be planted in spring, not fall. Seed is usually spread by hand or with a small broadcast seeder. It should be distributed as evenly as possible for good coverage. Light raking is important to increase the contact between the seed and the soil.

The following watering recommendation for establishment of warm season grasses is based on information from the company plants of the Southwest, Santa Fe, New Mexico: Water new seedings two times per day during the first 3 weeks, keep the soil damp. Water one time per day for 3 weeks, water two times per week for 1 month, water once a week for another month and water two times per month until frost. Cool season grasses will require watering once or twice a day depending on heat. Keep the soil damp until seed germinates. Then reduce watering to every day or every other day for 1 month, water two times per week for a month and water one time per week until frost.

Sod is planted during spring and summer. While Kentucky bluegrass sod is most commonly used, at least two turf type tall fescue sods and mixed wildflower carpet are currently available. The soil should be prepared as above, but 3/4" lower than the desired finished elevation to allow for the sod height. Water sod daily to keep the soil moist for 3 weeks or until established, decrease to twice per week for the bluegrass and decrease again after two months to once per week for the fescues. Established bluegrass can also be managed on weekly watering. It will not be quite as green, but it will survive.

Immediately after planting, all planting beds should be mulched to a depth of 3", except for beds with ground covers and new seedings. Ground cover areas should receive 2" of mulch and newly seeded areas should have about 1/4-1/2" of weed free straw or hay scattered on the soil surface. The mulch is particularly important for seeded areas to keep the seed and soil from drying out and to prevent formation of a soil crust.

Overplanting/Thinning

New landscapes look sparse while plant materials are still small. The plant sizes provided in the plant selection chart are mature size heights and widths attained in 20 years for some trees. To compensate for the temporary open spaces from lack of large vegetation, use filler plants (inexpensive fast growing foliage) and/or lots of mulch. Filler plants for temporary coverage could include annual flowers planted from seed or plants, bulbs, perennials that could be transplanted to another location later or ground cover. It may also be worthwhile to plant additional trees and shrubs knowing that some will be moved or removed

in 5 or 10 years.

References:

Water-Saving Gardening, Landscape Renovation, Nature's Design, Step by Step Landscaping, All About Landscaping, Underground Sprinklers, Lawn Sprinklers: A Do-It-Yourself Guide, Urban and Community Forestry, Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines, Garden Color, Perennial Gardens, Successful Perennial Gardening.

MAINTENANCE

Water Zone 0 and 1 Plants

Native and drought tolerant plants seem to grow best when they are neglected. "Neglect" means providing water only when plants are dry, leaving natural mulch undisturbed, allowing light shading from growth of companion plants, and letting succession work. Successional growth forces some plants out and encourages others. Resist moving plants until you have had a chance to identify them. They may be desirable plants. Often invasive plants such as boxelder trees or the native clematis vine will try to overtake and dominate natural plantings and they have to be removed.

Undesirable weeds should be removed as soon as they can be identified to reduce competition for limited water. Low water use plants require little or no fertilizer. Over fertilization can promote excessive top growth or cause salt problems in the soil.

If your soils are heavier (more clay and slower drainage) than the soils in a plant's natural habitat, it may be advantageous to loosen the surface of the soil twice a year to aerate and to increase water infiltration. Addition of mulch will help this but it may keep the soil too damp for certain plants. If you see yellowing of leaf tips and you notice that the plant looks wilted when the soil is damp, remove mulch, reduce watering, and observe the plant for signs of improvement. If the soils are too heavy the plant may die if it isn't moved to a soil with better drainage. Some plant enthusiasts incorporate enough sand into heavy soils to improve the drainage, but it takes yards of sand, removal of some original soil, and thorough mixing to amend a small area. If sand is not thoroughly mixed with soil, and layers of sand are left within clay soils, the conditions are worse for plants than if the soil was left undisturbed. Sand and clay mixes can also form a concrete like soil. Increasing drainage by amending with organic matter is usually better.

February and March are the best months to prune many native plants. Pruning is needed if there are dead or damaged limbs that should be removed, to reduce competition for sunlight if necessary, or to shape shrubs that are "too wild" in their growth habit for the setting. Refer to "pruning" on page 88, for ideas on how to prune.

Maintaining a grass/wildflower cover will require a fall mowing after the flowers have gone to seed. The objective is to spread the seed for the following years' plants. Getting seed-soil contact is important, so spot raking to incorporate seed after mowing will improve your results. Use the highest setting on the mower and be prepared for a "rough" look. After several years when the cover has filled in, it should not be necessary to mow.

Spring Mulch Mending

Replenish mulch to 3" in all beds, pulling it away from the base of the plants that were heavily mulched for winter. Refer to perennial flower books for recommendations on which plants need winter mulching.

Maintaining Turf

Aerating loam and clay soils should be done early in the spring before the grass is long. This helps to conserve water by improving the soils ability to absorb water. The value of power raking is questionable because it weakens existing grass.

Fertilize bluegrass during spring and early fall with N, 1 pound of N per 1000 sq. ft. per application, and add iron if the soil test indicates a deficiency. Other cool season grasses will benefit from early and late spring fertilizing with N, at a rate of .5 to 1 pound of N per 1000 sq. ft. Warm season grasses prefer late spring fertilization with N, at a rate of .5 pounds N per 1000 sq. ft. A balanced N-P-K fertilizer may be needed, refer to a soil test for best results. Remember that fertilizer promotes growth that requires more water, so don't over fertilize. Water immediately after fertilizing.

Recommended mowing heights for low-maintenance management of grasses: Kentucky bluegrass 3"-4", buffalo grass 1"-2", tall fescue 2"-3" and smooth brome 3"-5". This allows a deeper root system which permits less frequent irrigation.

Pest Control

An important approach to pest control is prevention. Maintaining good fertility is very important, over or under fertilizing contributes to pest problems. Plant observation and soil tests are your best guides. Watering efficiently is also important including using the correct amount of water, at the right frequency and at the best time of day to minimize evaporation and avoid promotion of disease. To prevent disease problems, leaves should not be wet over night so early morning watering is preferable. Plants susceptible to spider mites and borers should not be allowed to dry out, nor should they be planted in large groupings to attract these pests. Stressed plants attract problems. Early detection as a result of frequent regular inspection of leaves, branches and trunks can allow you a chance to remedy problems.

When pest problems are diagnosed, an initial reaction is to buy and apply chemicals to try to solve the problems. Don't overlook the possibility of controlling pests (weeds, insects, animals, fungi, and bacteria) without chemicals. Here are two good references: *The Encyclopedia of Natural Insect and Disease Control* and *The Encyclopedia of Organic Gardening*.

The key to controlling any pest problem is understanding the issue. The Cooperative Extension Service has information and handbooks available on pest control and you might also refer to *The Ortho Problem Solver.* Most large nurseries have this reference book. It has photographs to help you with diagnosis. *Urban and Community Forestry* has a section on tree pest identification and control and *Weeds of the West* is a good reference for identifying weeds prior to removing them. The *Commercial Horticulture Weed Control Handbook* is an excellent source of information concerning the use of herbicides in landscapes.

If weeds are a problem, pull or spray them and mulch the area with 3" of mulch. Install woven landscape fabric if you need additional weed control. Weed populations will decrease or disappear in 2 or 3 years if mulch is replenished to a depth of 3" each year. Mulch makes weeding easy! It doesn't take much effort to weed heavily mulched beds. If you use an herbicide initially, protect the desirable plants from chemicals.

Another part of the issue of pest control is what you are willing to give up. Landscapes aren't meant to be perfect; they are dynamic systems that change constantly, when one plant dies others grow. Evaluate the tradeoffs involved in eradicating

a pest problem before taking action.

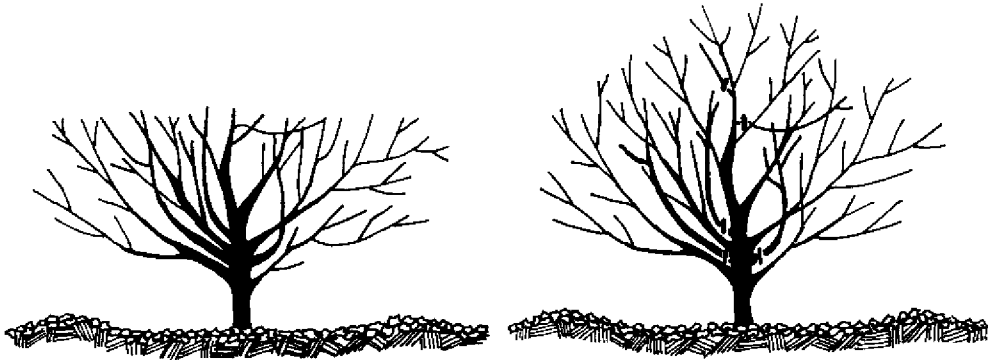


Figure 37 (left) Tree pruning.

Annual and Perennial Beds

You have a great opportunity to improve soil each year in annual beds. Try using well decomposed bark mulch in annual beds and turn it into the soil with nitrogen in the fall, in a few years most soils will be noticeably improved. Fertilize annuals in mid summer, keep them moist, and dead head them (remove old flowers) for more blooming. Loosening the soil around annuals and perennials allows water to infiltrate faster and it provides better aeration. Deep infrequent watering is important for developing deep root systems for perennials. A light application of 10-10-10 during spring or early summer will be beneficial for annuals and perennials. Some perennials must be divided each year, consult these references for specific information: *Perennial Gardens* and *Successful Perennial Gardening*.

Pruning

Pruning practices in northern Utah often leave trees looking like mowed grass. Never prune a tree to look like the tree on the left, Figure 37. This type of pruning invites structural problems. The tree on the right, Figure 37, will be properly pruned once the needed cuts are made as indicated by the vertical cut lines.

Pruning creates an open wound that invites insects and disease. Therefore it should only be done to: remove dead and damaged branches, remove weak branches, improve competition problems from shading, protect public safety and property, and encourage healthy growth and branching. Pruning timing is specific to types of plants.

Refer to the following references for information on pruning time and technique: *Urban and Community Forestry, Arboriculture-Care of Trees, Shrubs and Vines in the Landscape*, and *Complete Guide to Gardening*.

Fertilizing Trees and Shrubs

Nitrogen is the most important nutrient to apply for trees and shrubs. It should be applied every 2 years to zone 2-4 plants, and only if deficiencies are apparent for zone 0-1 plants. Phosphorus and potassium are commonly needed every 3-5 years. Yellow leaves, stunted growth and soil tests are the indicators that fertilizer is needed. Chelated iron Fe 138 may also be necessary in high pH soils. White areas between the leaf veins will appear on new growth if iron is deficient.

Fertilizer is commonly applied in the spring. It may be broadcast or applied in the soil through 6-24" deep holes. Subsurface feeding for trees may be preferable where there is turf, because of the danger of burning turf from fertilizer application rates above 2 pounds per 1000 sq. ft. For large trees, a grid of 1/2-1" diameter holes on 18" centers is used for applying dry fertilizer or for liquid injection. For shrubs, using holes only

around the drip line of the canopy will suffice. A piece of rebar, a drill or a soil probe can be used to make the fertilizer holes. Two to 4 pounds of active N is recommended per diameter inch of tree at breast height. Half of this amount is recommended for trees under 6" in diameter. Refer to *Urban and Community Forestry* for details.

Using this idea, a 7" diameter tree requires 21 pounds of N every 2 years. If a 15-10-10 fertilizer is used, the N is 15%, so 21 pounds divided by 15% = 140 pounds of fertilizer. A 2" tree would require 1 pound of active N, 1 divided by .15 = 6.7 pounds of fertilizer.

Fertilizer spikes or slow release tablets can also be used, according to the manufacturers recommendations and in conjunction with soil test recommendations. Fertilizer should be watered in thoroughly to discourage shallow rooting and to avoid burning ground cover vegetation.

Irrigation System Maintenance

Irrigation systems require regular checking for leaks and clogged sprinklers or drip emitters. If you are using a drip system, emitters should be quickly checked during each irrigation to see that they are working. Sprinkler heads don't clog as easily but they should also be checked regularly. Remove and clean non-functioning heads or emitters. Leaks are difficult to detect in buried irrigation lines, but a pressure test at the valve compared to a test at the end of the line will give you an indication of trouble. At the end of the fall season, water in irrigation lines should be drained at the lowest point in the system or blown out with an air compressor. Water left in the lines over winter may damage your system. Flush the system with water in the spring by opening the ends of the lines to remove accumulations that might clog the heads. Check the flow from the emitters and sprinkler heads again when the system is started at the beginning of the season.

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The Encyclopedia of Natural Insect and Disease Control, The Encyclopedia of Organic Gardening, The Ortho Problem Solver, Urban and Community Forestry, Weeds of the West, Perennial Gardens, Successful Perennial Gardening, Gardening, Landscaping and Grounds Maintenance.

Conclusion

Much of the success of water conserving landscapes will come from sensitivity to and appreciation for the environment. The more a person works with the landscape the more enjoyment there will be in seeing and trying to understand the interactions of complex elements.

This booklet has touched on the basics of residential landscaping and landscape gardening and has encouraged greater awareness of the environment. But this is like the first note of a symphony. The rest of the composition encompasses understanding birds, insects, animals, plants and medicinal herbs, aesthetic potential of the natural environment given an overwhelming human population and successional changes in a landscape.

The greatest contribution toward the furtherance of water wise landscaping would be to make the following local resource information readily available. Public information is needed on precipitation, evapotranspiration, temperatures, sun/shade angles, along with pamphlets on soils, native plants and animals, insects, local successional plant communities an supply system. Learning about the local environme a component of every child's education.

Research is needed on individual and groupec requirements. There are questions about what v reduced irrigation will have on the landscape whe plantings have existed on water from over irrigatior beneficial to have more information on maintenar plant communities in landscapes. But, perhaps the diate need is for preservation of natural areas diversity of plant and animal species.

Appendix A:
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OTHER WATER-WISE LANDSCAPING SOURCES

Extension Publications
Utah State University
Logan, UT 84322-3060

Xeriscape Colorado
Denver Water Department
Denver, CO 80254

National Wildflower Research Center
2600 Farm to Market Road 973 North
Austin, Texas 78725

Utah Native Plant Society
P.O. Box 520041
Salt Lake City, UT 84152-0041

Red Butte Garden and Arboretum
Wakara Way
Salt Lake City, UT

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