Waterwise Gardens

by Thomas Christopher

Water is the stuff of life, in the most literal sense. Almost two-thirds (by weight) of every gardener's body is water. And the proportion is even greater in most of our plants. Herbaceous plants—a category that includes annual and perennial flowers, grasses, most herbs and vegetables—are typically 80 to 90 percent water by weight, and in some especially succulent ones, such as lettuce and cacti, the water content is as high as 95 percent. Even woody plants, our seemingly solid trees and shrubs, are about half water.

Plants are rich in water for a very good reason: it's fundamental to almost every aspect of their life and growth. It's water that carries minerals up from the soil and into their roots; and it's water that carries the nutrients from the photosynthesizing leaves to nourish the rest of the plant. Water inflates the cells to give the plant's tissues rigidity. It also provides the plant with a cooling system. By evaporating water off the surface of the leaves during hot weather, plants protect themselves from the botanical equivalent of heat stroke, much as you cool yourself by sweating. This last, the cooling process botanists call transpiration, accounts for most of a plant's water use: in warm, sunny weather, each leaf may transpire an amount of water equivalent to its own weight in just one hour. Most of the damage a plant experiences during periods of drought, at least initially, isn't caused by dehydration so much as by the switching off of its cooling system and the consequent overheating of the plant's tissues.

Understanding how a plant uses water might seem to be of interest only to botanists, but in fact it's also your secret for turning irrigation into a precise and potent gardening tool. Some mention was made in the introduction to this book about the huge wastage of water that is intrinsic to conventional gardening methods, and the role this plays in draining rivers, lakes, and aquifers. It's essential to understand, however, that this wast-

This designed meadow does very well without irrigation: a bioswale helps to conserve water on site. Photo by Saxon Holt.

age of water is just as harmful, in the long run, to the garden. Overwatering of the sort practiced by most American gardeners washes the fertility out of the soil (and into nearby waterways, where it becomes a major source of water pollution). Giving a plant excessive amounts of water encourages soft, overly lush, plant growth that makes your garden a target for all kinds of pests, ranging from aphids to deer. It also encourages the spread of plant diseases.

In addition, overwatering promotes invasion by those opportunistic, aggressive plants we categorize as weeds. It's worth noting in connection with this that weeds are, overall, one of the best indications of whether you are gardening sustainably. They are a class of plants that has evolved in partnership with mankind, adapting to take advantage of the environmental disturbances we promote, and to seize on the resources we waste through such behavior. When a farmer strips a field of vegetation with his plow, weeds rush in to claim the unoccupied soil. When you over-fertilize your plantings, weeds spring up to make use of the nutrients that your shrubs or flowers cannot absorb. Likewise, if you apply more water to your garden than it needs, weeds will surely spring up to claim the excess. If, therefore, you find yourself devoting much time and effort to weed control, it is probably an indication that, among other things, you are too free with your irrigation.

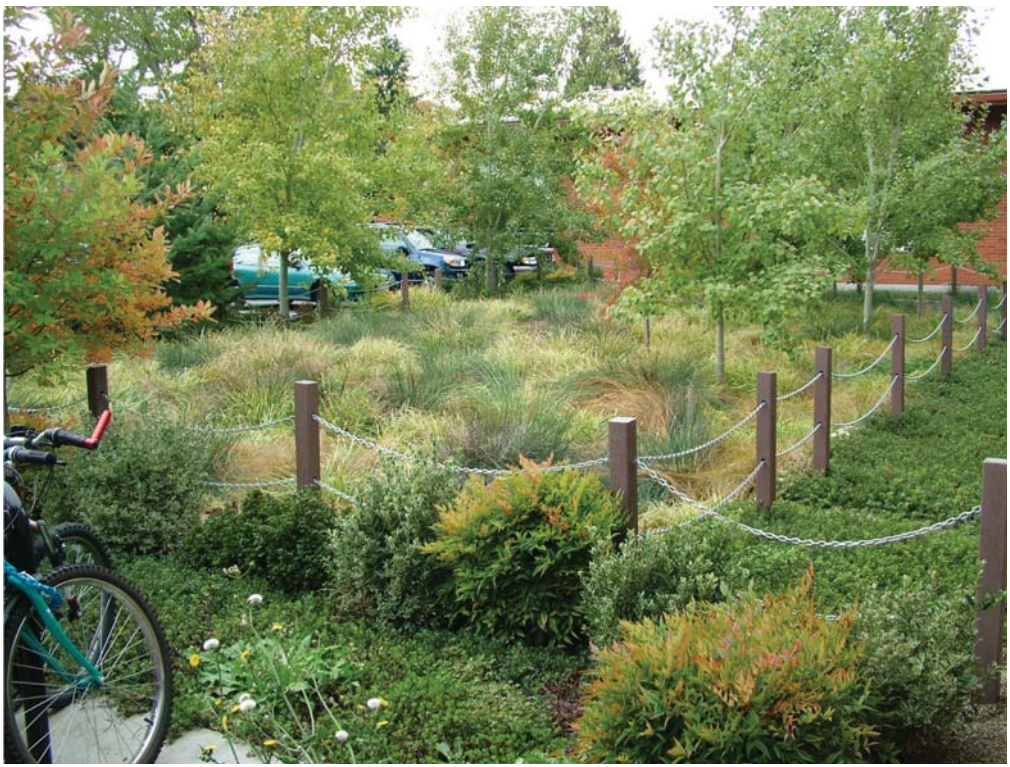
Reducing water use in the garden

As shortages in the public water supply system have become chronic in many parts of the United States, especially in the Southwest, over the last generation, gardeners in the affected regions have developed strategies and new types of design that minimize the need for irrigation. So far, however, this has remained for the most part a regional movement. "Xeriscaping" and "desertscaping" may have attracted a good deal of attention in Arizona and New Mexico, just as "prairiescaping" has won popularity in the drier areas of the Plains states, but gardeners in the moister parts of the country have typically paid little attention, taking the attitude that landscape water conservation is something to be practiced in the desert or arid West, but not in New England, Georgia, or Minnesota.

What these holdouts are discovering, however, is that unsustainable landscape practices can stress water supply systems even where natural rainfall is abundant. After all, the decisive point when it comes to irrigation is not just the scope of the local water supply, but also the quantity that can be delivered (sustainably) through the local supply system. In many cases, these delivery systems have failed to keep pace with local development; suburbanization not only creates an increased demand for water in formerly rural communities, it also makes difficult or impossible the condemnation of land to create new reservoirs. Meanwhile, industrial development

has often polluted streams, rivers, and aquifers that were once useful sources of fresh water, so that they are no longer potable. The net result has been that areas that wouldn't seem likely to suffer shortages, do. Dade County, Florida, for instance, the home to the Miami metropolitan area, enjoys an average of 53 inches of rainfall annually, distributed over 131 days of storms. Yet because of an undersized storage system and groundwater pollution, the local water utility finds it difficult to satisfy its customers' needs and regularly imposes landscape watering restrictions.

One reason that landscape and garden irrigation has become a bugaboo of water managers is that irrigation tends to create seasonal spikes in water consumption. Typically, watering increases dramatically in summertime—in many areas of the West, it temporarily doubles the demand on the public water supply system. In



Waterwise garden at a school in forward-thinking Portland, Oregon.

many regions of North America, the summer season of warm weather, when temperatures are suitable for plant growth, is also a dry season, when reservoirs are not being replenished by rain or melting snow. The problem this creates for a water utility is obvious: peak demand coincides with a period of reduced supply.

Even if you and your neighbors draw your water from private wells, your landscape irrigation may have an impact on the public water supply. The Ipswich River, for example, a source of drinking water for fourteen towns in coastal Massachusetts, runs dry every summer now in part because of water pumped from private wells—this pumping may keep plantings green, but it sucks the underground reservoir, the aquifer, dry, which in turn drains moisture from the adjacent river. Nor is this an isolated instance. Many streams and even rivers that once ran year-round now disappear in summertime because of unsustainable demands on the local aquifers.

To keep your garden from becoming this sort of environmental burden, you should free it, as much as possible, from its dependence on irrigation. It's unlikely that you will ever entirely eliminate the need for this sort of support. It would be difficult (if not impossible) to garden without injecting at least some extra water into the landscape. New plantings, even if they are of species adapted to the local climate, are going to need some judicious watering until their roots have grown out into the surrounding soil. You'll greatly enhance both the quantity and quality of vegetable and fruit crops by keeping the soil around their roots moist through periods of drought. Timely, just-enough irrigation also boosts the floral display of annual and perennial flowers. Besides, even the water-thriftiest gardener may want to enhance with some extra water the lushness of the plantings immediately surrounding a deck or terrace used for outdoor entertaining and dining, or relaxing on weekends. Still, even with all these uses for your hose, it is possible as a gardener to reduce your water use dramatically, by 75 percent or more.

Weaning your garden off the irrigation habit begins with a detailed analysis of your particular situation.

GETTING THE MOST OUT OF IRRIGATION

To create an impression of lushness, concentrate irrigated plantings around the area of your landscape where you spend the most time. A couple of lavishly flowering tubs placed on a deck, or a band of colorful flowers encircling a terrace make a disproportionate impression. Outer, less prominent areas of the landscape can be left to more self-sufficient but less decorative plants, such as ornamental grasses and deep-rooted shrubs.

Assessing local climate

It's revealing that the traditional guides created to help gardeners find plants appropriate to their local climate deal solely with temperature. For example, the USDA Plant Hardiness Zone Map (the map you find in the back of every nursery catalog) divides the United States into different numbered "climate zones" solely on the basis of the average low temperatures experienced in wintertime in each area. Of course, availability of water is at least as crucial to plant growth as tolerance to cold, but clearly, the presumption is that unlimited water for irrigation may be had just by opening your tap. In other words, the USDA map classifies Naples, Florida, as identical with Victorville, California, even though Naples receives 51.9 inches of precipitation annually, while Victorville gets less than 7.

Fortunately, it isn't hard to develop a better profile yourself. You can download the necessary information for free from the National Climatic Data Center website. Go to its homepage, at www.ncdc.noaa.gov/oa/ncdc.html, and click on "Free Data" (you'll find this under the "Data & Products" menu). Scroll down to "Free Data C" and then select your state, and after that the weather station nearest to your place of residence. What you'll get for this is a list of monthly averages over a thirty-year period (1971–2000). These include the average high and low temperature experienced at that station each month, but also the average precipitation in inches and—this is important—the average number of days each month on which rain, snow, or ice fell, and how many days on which the total accumulation was 0.01, 0.1, 0.5, or 1 inch. This may seem like more information than you want, but it will give you an idea of how evenly distributed the precipitation has been. That is crucially important, after all. Even if your average rainfall during the summer is 4 inches a month, if this falls in just a few big storms, your plants (unless you have chosen only deep-rooted, drought-resistant species) are going to suffer from thirst during the hot, dry intervals between the storms.

Perhaps the most important knowledge to be gained from this website, though, is the total annual precipitation received in your region. This number provides a very useful clue about what sort of vegetation will do best in your garden.

- Less than 10 inches of annual precipitation qualifies your region as desert, although Americans tend to stretch this definition, labeling as "desert" locations such as Tucson, Arizona, that typically receive an inch or two more per year than the official maximum. When planting a garden in an area of this sort, you should use drought-adapted plants, and space your plantings in the manner of a desert, where the roots of individual plants occupy extensive spreads of soil so that they can tap more of the moisture that does fall from the sky. Groundcover plants and turf are out of place in such a set-

ting, and trees should be planted very sparingly and should be of a desert-adapted species such as palo verde (*Parkinsonia* spp.) or mesquite (*Prosopis* spp.).

- Annual precipitation of 10 to 20 inches, in most of the United States, indicates a steppe or grassland climate. Precipitation in the lower part of that range is typical of shortgrass prairie, while precipitation toward the upper part defines a tallgrass prairie. Both types of prairies are dominated by grasses and perennial flowers, which protect themselves from the extremes of the prairie climate by investing most of their growth in their roots (as much as 90 percent by weight of a prairie grass is found below the surface of the soil). Any nursery that specializes in prairie plants can help you distinguish which species of plants will thrive in your climate. The important thing to remember is that trees and most shrubs are, from the perspective of water consumption, a luxury in such a climate because most will require regular irrigation. As a designer, you should think hard about where you need shade and how to dispose the trees so that you get the maximum advantage from each. One of the great joys of a steppe garden is that it provides an ideal setting for many kinds of bulbs, most of which evolved in grassland habitats.
- Annual precipitation in excess of 20 inches will generally support a woodland garden. Conifers such as pines tend to be more successful in harsher climates with less rainfall and where seasonal droughts are a regular occurrence. Hardwood forest is more typical of regions where annual precipitation ranges from 30 to 50 inches. Keep in mind that in an area where woodland is the natural flora, meadow or any other kind of grassed area will probably require regular cutting to keep trees and shrubs at bay.

When the rain or snow falls is also a crucial factor to consider when planning your garden. Coastal central and southern California, for example, has what is commonly classified as a Mediterranean climate. That is, most of the precipitation falls in the wintertime, while summers are hot and dry. Cultivating plants from the traditional palette American gardeners adopted from northern Europe is possible, but only with constant summertime irrigation. A far more sensible solution is to cultivate plants native to the area, which naturally go dormant in the summer, or else plants from areas with similar climates such as the Mediterranean basin, western and southern Australia, or southwestern South Africa.

Assessing topography

How quickly and completely your garden absorbs any precipitation that falls on it is

determined by the soil and topography of your site. These two factors also influence how long your garden stays moist.

Topography is the shape of your garden—the slopes, dips, and level spots. These features affect how much moisture tends to settle into the ground at each spot. Slopes shed water, so the soils on slopes tend to remain drier. The steeper the slope, as a rule, the drier it is. Depressions, areas lower than the surrounding terrain, collect water. Level areas don't shed water like a slope but don't collect it, either. The orientation of the slopes is also important: south- and west-facing slopes receive the most intense sunlight in the northern hemisphere, so plants growing on them are particularly prone to drought.

The best way to get a feeling for the topography of your garden is to make a tour of inspection right after a heavy rain. Bring a spade and use it to cut a slice of soil 12 to 18 inches deep in the different areas, on the slopes, dips, and levels, to see how deeply the water has penetrated at each spot. Repeat this inspection a couple of days later, to assess how quickly the moist areas dry.

Track the runoff to determine which areas of your garden tend to shed the precipitation that falls on them and identify the route the water follows off site. In the north, this is easiest to do during a late winter or early spring thaw. The ground is frozen and non-absorbent then, so any water produced by melting snow or ice is likely to end up as runoff. Pay special attention to downspouts from your roof, since these are particularly abundant sources of runoff during storms. The important point to remember is that runoff is a natural irrigation source for your plants, if you can redirect and trap it.

Assessing and improving the absorption rate of your soil

Soil, specifically its absorption rate, is the other major factor that determines what your garden will do with any moisture that falls on it. To identify the rate at which your soil absorbs moisture (what gardeners have traditionally called "drainage"), perform the following five steps.

1. Dig a hole 18 inches deep and 6 inches wide at the proposed location.
2. Fill with water and allow to drain completely.
3. Wait twenty-four hours, then refill the hole with water to the top.
4. Stick a yardstick upright in the middle of your hole, and with it measure how far (in inches) the water level drops at one-hour intervals until the hole is empty.
5. Divide the depth of the hole (18 inches) by the total amount of time required for all the water to be absorbed to identify the average rate of absorption.

The rate at which the water is absorbed into the soil reveals a couple of important things. First, it indicates how much your

garden is likely to benefit from storms. If your soil absorbs water slowly, at a rate of only 0.5 inch per hour for example, then most of the water dumped on it by a heavy rain storm—one that deposits several inches of rain in a few hours—is likely to be lost as surface runoff or to pool in low-lying areas, creating boggy conditions that are fatal to most non-wetland plants.

Knowing the absorption rate of your soil also helps you calibrate your irrigation.

It is possible as a gardener to reduce your water use dramatically, by 75 percent or more.

If you know that your soil absorbs water slowly, then it makes sense to water in a couple of brief sessions, leaving an interval between the waterings for the moisture to be absorbed, rather than in one intensive irrigation. Trying to make that soil absorb a lot of irrigation all at once is likely to result in surface runoff and waste.

Knowing its absorption rate also provides a clue about how long your soil will retain moisture. As a rule of thumb, porous soils that absorb water rapidly (more than 4 inches per hour) also dry out more quickly. One way to correct such fast-draining soils is to boost the amount of decomposed organic matter, or humus, they contain. Humus acts like a sponge, absorbing and retaining many times its own weight in water, so a humus-rich soil loses moisture more slowly. At the same time, humus also encourages the mineral particles in the soil—particles of clay, silt, and sand—to combine into large particles, or "crumbs," which aggregation makes the soil more porous. In this way, humus can also improve soils with slower rates of absorption.

To boost the water absorption and retention of your soil significantly, you must apply a considerable quantity of humus. The most practical way to accomplish this is to identify some locally abundant (and so inexpensive) raw organic material, such as wood chips, autumn leaves, or spoiled hay. Spread this as a mulch, a couple of inches thick, on any area of soil you intend to plant. Mulch insulates the soil beneath it, keeping it cooler, and by reducing the evaporation of moisture off the soil's surface, it also keeps the soil moister. These conditions enhance root growth; they also favor the proliferation of earthworms who feed on the mulch, eating particles of it as it decomposes, then carrying them down into their tunnels, to incorporate the organic material into the topsoil. Replenished as it decomposes, a mulch of this sort will, over time, substantially boost the organic content of the soil, which helps to aerate it, increasing its ability to absorb water while also increasing the soil's abil-

ity to retain moisture. In the short term, an organic mulch will reduce soil fertility, because it will absorb nitrates (a major plant nutrient) from the soil as it decomposes. For this reason, the application of such a mulch will probably increase your plants' need for fertilization in the short run. As the organic matter finishes its decomposition into humus, however, it releases back into the soil the nitrates it absorbed earlier. What's more, the maturing humus releases these nutrients at a slow, steady rate that is much more beneficial for plants than the quick flush of nutrients released by most commercial fertilizers.

Working with your topography and soil

The highest skill in gardening is the ability to recognize and take advantage of the opportunities that nature presents. Rather than selecting plants that appeal to you during trips to the garden center and then imposing them on your site, try to match plants to appropriate settings. A drought-prone, south-facing slope, for example, would be a good place to plant deep-rooted, drought-tolerant shrubs, or herbs, perhaps together with spring bulbs that flourish during the late winter or spring when temperatures are moderate (and the soil's still moist from snowmelt or spring rains) and then go dormant during the heat of the summer. A low-lying, damp spot is an obvious location for ferns and other moisture-loving plants, or floodplain shrubs and trees such as swamp azalea (*Rhododendron viscosum*), witch hazels (*Hamamelis* spp.), pin oak (*Quercus palustris*), and sweetgum (*Liquidambar styraciflua*).

One excellent source of information about plants adapted to your climate, soil, and topography is the Native Plant Database maintained by the Lady Bird Johnson Wildflower Center (www.wildflower.org/plants). Though based in Austin, Texas, the database offers detailed information on more than 7,000 native plants suited to every region of the United States, so that you can find the right species not only for your climate but also for the conditions found on your site. And because of their interest in reducing landscape irrigation, local water companies and utilities can often provide lists of regionally adapted, drought-tolerant plants. Inquire at your municipal water department for the availability of such information.

Often, identifying native plants that thrive with minimal irrigation in your garden will provide clues about exotic (nonnative) species that will thrive there as well. If American witch hazel (*Hamamelis virginiana*) performs well in your garden, chances are good that any of the spectacular Asian witch hazels and their hybrids will feel at home there, too. This can be crucial to broadening the appeal of your plantings: whereas the American witch hazel blooms in fall to early winter, the Asian witch hazels bloom from late winter through early spring.

Local botanic gardens and arboreta are also fertile sources of information about plants adapted to the regional climate and different degrees of soil moisture. For addresses about such public gardens in your region, contact the American Public Gardens Association (see under Chapter 7 in "References, Resources, and Recommended Reading"). The New England Wild Flower Society, one of the oldest and most active native plants organizations in the United States, also maintains a directory of regional plant societies operating within every region of the country. This list is available online, at www.newfs.org/publications-and-resources/native-plant-societies.html.

Water harvesting and rain gardens

Capturing and storing storm runoff is an ancient but still very effective technique for boosting garden moisture in areas with dry climates. Recently such water harvest-

CLUES TO WATER-CONSERVING PLANTS

- Gray or silvery foliage. These colors reflect sunlight rather than absorbing it, so that the plant doesn't use as much water for cooling itself.
- Downy or hairy foliage. The hairs shade the leaves, which reduces the amount of water the plant uses to cool itself.
- Small leaves or needled foliage. By reducing the surface area of its leaves, a plant reduces the amount of water lost through its foliage, tending to make the plant more drought resistant.
- Fleshy, thick stems and leaves. These are another clue to drought-tolerance, especially if the foliage and stems are covered with a glossy, waxy skin, such as is found in cacti and sedums.
- Ephemeral growth pattern. Many wildflowers and most flowering bulbs are genetically programmed to emerge from dormancy and flower during a season that typically experiences moist, cool weather in their native habitat. The plants then go dormant and retreat back underground during the drier, hotter season that follows. Such plants require little irrigation and are highly drought resistant. Spring ephemerals (crocuses, daffodils, trilliums) are more common in northern regions; in the South, there are also fall or winter ephemerals, such as schoolhouse lilies (*Rhodophiala bifida*) and the different species of *Lycoris* (lily-like relatives of amaryllis).
- Cool season annuals. Plants that flourish and bloom during the spring or fall in the North and in the winter in the South typically require far less irrigation than flowers that bloom during the summer heat.

ing has been attracting attention even in regions with wet climates as a way to protect and enhance the water supply. Not only does water harvesting reduce the need for other forms of irrigation, thus lightening the demand on the public supply system, it also minimizes a major source of water pollution. As storm runoff washes over the surface of the soil and down the gutter, it picks up all sorts of pollutants, from excess lawn fertilizers and pesticides to animal feces and oil leaked from automobiles. Clearly, if the runoff pours without treatment into local waterways, this promotes pollution. It can cause even greater harm to local water supplies if, as is the case in most cities and towns, the runoff is channeled through storm drains into the municipal sewer system. Then the big surge of runoff that follows any major storm is likely to overwhelm the water treatment system and sweep raw sewage into streams, rivers, or coastal waters.

For this reason, the U.S. Environmen-

A roadside swale in Portland, Oregon.

tal Protection Agency has been encouraging cities and towns to trap runoff near the source in "rain gardens." These are shallow, unlined basins that collect and hold the excess water until it infiltrates the ground, where it is cleansed by plant roots and soil microbes. Progressive communities such as Portland, Oregon, have begun to include plantings of this sort into the green strips that flank their roads. But private gardeners have an even more important part to play in this effort, because the cumulative effect of their efforts can be immense. Besides, their rain gardens, each reflecting individual inspiration, will surely be more interesting.

Siting your rain garden

The first, and most important, principle of sustainable gardening is to work with nature rather than trying to dominate it. In the case of rain gardening, this means bringing the garden to the water, rather than vice versa. In most yards the most considerable source of stormwater runoff is the roof of your house. As a rule of thumb, a roof, whether flat or pitched, yields about 0.6 gallons of runoff for every square foot of ground space it covers for each inch of rainfall. In the case of a modest structure measuring 20 feet by 50 feet, that's 600 gallons (approximately 80 cubic feet) of water. Most yards include other sources of runoff as well: the water that washes off the surface of the driveway, for instance, or the water that washes down a slope. The object of a rain garden or gardens is to capture and absorb these flows before they exit your property.

The study you made of surface drainage in the course of your garden site analysis of topography (see page 147) will help you select the most effective site for this new landscape feature. Be sure to test the drainage in any spot you select:

1. Dig a hole 18 inches deep and 6 inches wide at the proposed location.
2. Fill with water and allow to drain completely.
3. Refill the hole with water to the top.
4. Measure how far the water level drops at one-hour intervals.

If the level drops an inch or more per hour, the soil is suitable for a rain garden. Here are some more dos and don'ts of siting a rain garden:

- A flat spot is ideal—excavating a basin that will retain water on the side of a slope requires digging deep on the uphill side and banking up the downhill margin.
- A slightly sloping site, one with as much as a 10 percent slope (i.e., the ground drops 1 foot for every 10 feet you move downhill) is also acceptable.
- Do not place a rain garden within 10 feet of your house—otherwise, the collected runoff may seep in through the foundation.
- Do not locate a rain garden over a septic field.
- To ensure vigorous growth of the

rain garden's plantings, don't locate it under the canopy of a tree. Instead, set it out in the open, where it receives direct sunlight at least half of each day.

It is possible to redirect runoff by excavating a broad, shallow channel, or swale, that intercepts the flow and leads it off in a direction different from the one it would naturally follow. However, unless you aspire to the role of canal-builder, it is best to locate the rain garden as close as possible to the natural flow of the runoff. Keep in mind that a swale must run downhill to move the water—a carpenter's level set on a long, straight board or a string with a line level (available at most hardware stores) stretched tight between two stakes will help you read the incline of your topography accurately. Keep the swale shallow to avoid creating a hazard for walkers; a channel 4 inches deep and 2 feet wide should be adequate, especially if you bank up the edges of the swale with the earth excavated from the middle. To keep the swale from turning into a source of soil erosion, line it with turf or with coarse gravel and rounded stones so that it resembles a creek bed.

When diverting water from a downspout to a rain garden, you may find a length of buried, corrugated polyethylene drain pipe more efficient than a swale. In any case, you must adapt your downspout to make sure that the runoff doesn't infiltrate your foundation. Tapping a downspout is easy:

- Use a hacksaw to cut the downspout 9 inches above the ground.
- Attach a 90° downspout elbow (obtainable at most hardware stores) by inserting the upper end of the elbow into the bottom of the downspout. Secure the joint with sheet metal screws.
- Slip the end of a length of corrugated plastic drain pipe over the other end of the elbow; the drain pipe should be of a slightly larger diameter than the elbow (4-inch pipe should serve, but check the width of the elbow before purchasing). Secure this joint, too, with sheet metal screws.

This type of pipe is flexible, so you can use it to direct the water in any direction, as long as it runs downhill from the mouth of the downspout elbow. If you are feeding the water into a swale, the pipe should extend at least 5 feet from the house. Alternatively, bury the pipe in a shallow trench, extending it all the way to the uphill edge of the rain garden. Use a level to make sure that the drain pipe runs continuously downhill, with no upward interruptions that will impede the flow.

Designing, contouring, and digging

The size of the rain garden you create depends in part on the size of the space available but also on the amount of runoff you intend to harvest. A good rule of thumb is to make the area of the rain garden 10 percent of the area that drains into it. In other words, if you intend to capture and infiltrate all the runoff from your roof,

and the footprint of your house is 1,000 square feet, then the area of your rain garden should be 100 square feet. If you feed the water from different downspouts into different rain gardens, the *total* area of those rain gardens should still be 100 square feet.

A garden hose is a useful tool for designing the perimeter of the rain garden—you can lay it out on the ground, trying different shapes and curves until you find a contour that pleases you. If you are installing a rain garden on a sloping site, you'll save yourself a lot of digging if you make the basin of the rain garden long and thin, following the contour line of the hill. Use a carpenter's level or a string with a line level to ensure that the length follows a level line across the face of the slope.

Moistening the soil (if it's dry) before you dig will make excavation easier. If the basin sits on a slope, all the excavated earth should be piled outside the downhill side to raise that edge so that the basin will hold water. Your line or carpenter's level will help you match the heights of the uphill and downhill edges, as well as helping you to keep the floor of the basin level.

How deep you make the basin of the rain garden depends partly on the character of your soil. The goal is not to create a pond. The water must drain out of the rain garden within a couple of days of the storm so that the garden doesn't become a breeding ground for mosquitoes (mosquito eggs take a minimum of seven days in standing water to hatch). In general, a basin 4 to 8 inches deep works well, but you should excavate a couple of inches deeper than the basin's intended final depth, to make room for a generous layer of coarse sand and compost (or some other organic material, such as decomposed bark). Dig this into the basin floor to enhance water absorption and create a good bed for the roots of the rain garden plants.

Give the basin a saucer-like profile with gently sloping walls, piling the excavated earth around the edge of the basin in a shallow berm. Pat the enclosing berm firm with the sole of your shoe or the blade of your shovel—the berm must resist the outward pressure of the water when the rain garden fills with runoff. To further protect it against washouts, plant the berm with grass seed or drought-tolerant prairie and ornamental grasses tucked in with straw or some other mulch.

PLAY IT SAFE

At least seventy-two hours before you start excavating, place a call to 811. This national clearinghouse will contact utility companies in your area who will, if necessary, send a locator out to mark the route any buried utility lines (gas, electric, water) take through your yard.

Planting your rain garden

A rain garden actually provides two different types of habitat, and to make its planting a success, you must select species suited to each. The upper edge of the rain garden's side and the berm that encloses it are designed to be impervious to water; the soil there will tend to be dry and any plants you grow in it must be drought tolerant. The floor of its basin, on the other hand, with its cycle of flooding and draining, requires plants that can thrive in both wet and dry soils.

Unfortunately, because of regional variations in climate and soil, it isn't possible to prescribe a single list of rain garden plants for the whole of the United States. It is possible, however, to suggest the classes of plants that will perform well. In general, perennials and shrubs are better choices for a rain garden than annuals; their roots persist year-round, helping to stabilize the soil even

Ornamental grasses and other plantings protect this City of Portland vegetated swale from washouts.

SHOPPING FOR PLANTS

To stabilize the soil in the rain garden and protect it from erosion, it's essential that the plantings spread their roots quickly. For this reason, it's best to start with well-rooted, container-grown plants. Use only nursery propagated plants; never use plants collected from the wild.

during seasons when they are dormant. In arid climates, a rain garden provides an ideal planting opportunity for a deep-rooted, drought-tolerant tree; the water that collects in the basin will soak deep into the ground and provide a long-lasting reservoir for the tree, and surrounding the tree with a gravel mulch will reduce water lost from the soil through surface evaporation. Deep-rooted, drought-tolerant prairie or meadow grasses and flowers, where adapted to the local climate, are good choices for the berm and lip of a rain garden.

Rain garden in a residential development, Portland, Oregon.

For the floor of the rain garden, perennials native to seasonal wetlands (areas that flood for part of the year but dry up, typically, during the summer and autumn) are good choices; examples include swamp milkweed (*Asclepias incarnata*), blue flag iris (*Iris virginica*), and swamp sunflower (*Helianthus angustifolius*). Floodplain shrubs (shrubs native to areas along rivers and streams that flood during times of high water) also do well in the rain garden floor; examples include red osier dogwood (*Cornus sericea*), buttonbush (*Cephalanthus occidentalis*), and meadowsweet (*Spiraea alba*). Many sedges (*Carex* spp.) and rushes (members of the genera *Scirpus* and *Juncus*), with their attractive, grass-like appearance, make a good background to these wetland and floodplain flowers and shrubs. Check with local native plant nurseries for species adapted to your region.

Landscaping your rain garden with native plants will make it an oasis for butterflies, birds, and amphibians, and ensure that it doesn't serve as a nursery for invasive plant species.

Maintaining the rain garden

Until they extend their roots into the surrounding soil, your new plantings will be very vulnerable to drought. Immediately after planting, water the new plants thoroughly, moistening the soil to a depth of several inches. Repeat this treatment weekly during periods of rainless weather throughout the first growing season. By the second season of growth, such irrigation should be unnecessary.

The other care you must provide while the plants establish themselves is to keep the rain garden free of weeds. Periodic hand-pulling is the best way to accomplish this. Again, the need for this care should be temporary: as the rain garden plants infiltrate the soil with their roots and spread to fill the available space, they will gradually crowd out any invading weeds.

After the plants have root in and knit together, virtually the only care the rain garden should require is periodic pruning. Leave the stalks and seedheads of the perennials, grasses, rushes, and sedges in place through the winter. They'll provide food and valuable cover for wildlife through that season of scarcity. In early spring, though, just before growth resumes, cut the dead material back to a height of 6 inches or so with a string trimmer or hedge shears. This will stimulate vigorous new growth and eliminate overwintering pests.

CHAPTER 8