

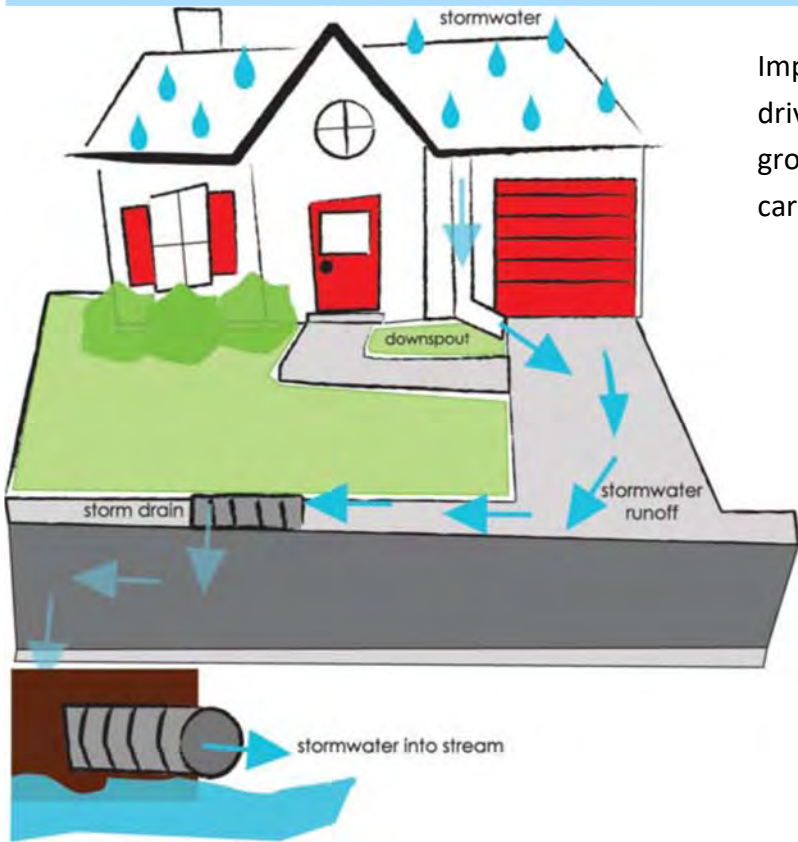
stormwater gardening simple . valuable . artistic expressive . beneficial . easy

a beautiful solution to stormwater pollution

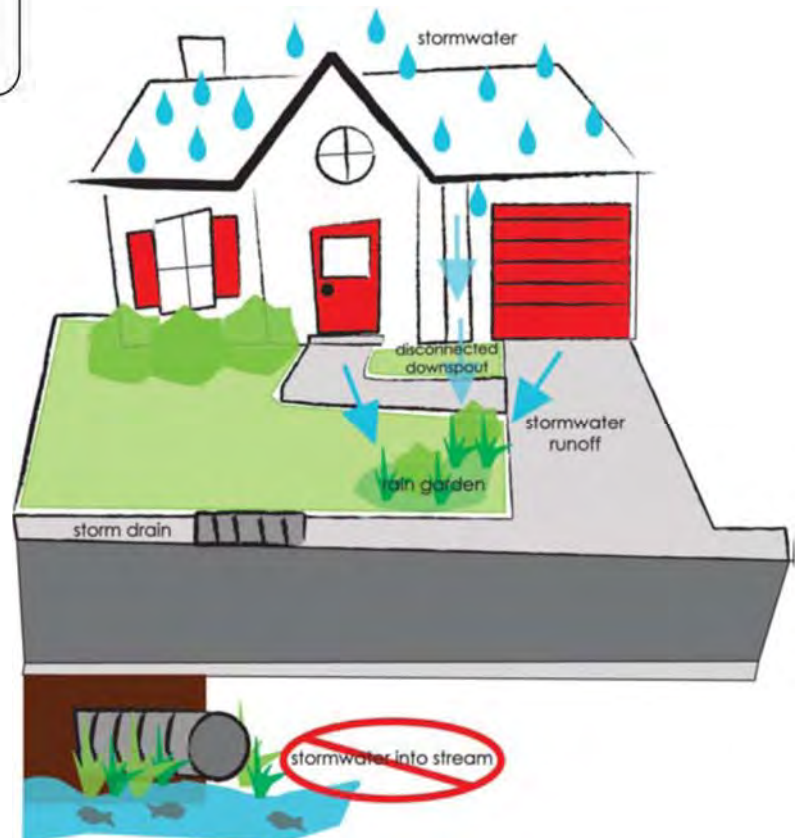
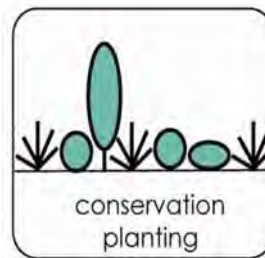
know your rainscaping

This series of factsheets provides an overview of rainscaping: the purpose, the techniques and the benefits of adding landscape enhancements to reduce stormwater runoff. Use the factsheets to help you incorporate rain into your landscape.





Impervious surfaces (hardscape) like roads, sidewalks, driveways and roofs prevent rain from filtering into the ground. Stormwater quickly enters drains and streams, carrying pollutants with it.



Rainscaping captures the rainfall for your landscape. Stormwater enters the ground slowly instead of rushing off, preventing pollution and helping to restore stream habitats.

the stormwater issue:

Impervious surfaces (hardscape) like roads, sidewalks, driveways and roofs prevent rain from filtering into the ground. If rainwater cannot infiltrate the soil, it races downhill, collecting pollutants and eroding our landscapes along the way. The additional volumes of water, sediment and pollutants then empty into streams and tributaries, disrupting habitats downstream. You can make a difference, though, by rainscaping your yard!

what is a rainscape?

Rainscapes are landscape enhancements that reduce stormwater runoff. Most rain that falls on hard surfaces flows to a creek or a storm drain. Storm drains then flow into creeks. This stormwater runoff carries pollutants, causes flooding, erodes streambanks and disturbs aquatic habitats.

In contrast, rainfall on natural surfaces like gardens, forests and meadows soaks into the ground, replenishes groundwater and streams, removes pollutants and provides water for plants. Rainscapes simulate natural drainage to intercept, capture and absorb rain.

This series of factsheets will provide the details you need to rainscape your own yard.

rainscaping techniques defined:



Rain Barrels Capture rainfall coming off roofs and out of gutters and downspouts. They store rainfall to use in the garden at a later date. Once they're full, they must be emptied. Cisterns are similar to rain barrels, just larger. They can be buried or set above ground.



Disconnecting Your Downspout is about detaching a downspout from the storm drain system or driveway and redirecting rainwater to soak into your yard or landscaping. You can also direct water from your downspout or rain barrel (overflow) to your rain garden.



Conservation Plantings Naturalize your landscape to allow rainfall to infiltrate. Turf areas are usually compacted and slightly impervious. By removing turf; aerating and amending the soil; and planting trees, shrubs or perennials, more rainwater can absorb into the ground and plants' roots, preventing additional runoff.



Rain Gardens are slightly recessed gardens designed to capture and temporarily hold rainfall flowing through your yard (runoff). Water moving through the rain garden irrigates the plants and rids itself of pollutants through the plants and soil.

how to decide which one is best for you:

The great thing about rainscaping is you can use one or more techniques to suit yourself and the needs of your landscape best. For instance, if you live in a townhome with a small yard, a rain garden might not be appropriate due to size limitations, but a cistern or rain barrel may be perfect to help you water those patio plants. For residential and commercial landscapes that can afford the space, rain gardens provide the greatest benefits. They remove and filter stormwater, while providing beautiful scenery within your landscape. Some homeowners find a combination of techniques is the best solution, such as a rain barrel and raingarden. If you want to help, but have little time or money, downspout disconnection is for you!

what are the benefits?

environmental: Rainscaping helps restore stream health, recharge groundwater and provide habitat for plants, animals and birds.

economic: Rainscaping reduces water costs, reduces energy costs and increases property values. Some municipalities even offer credits or rebates to homeowners with rainscaping in their yards.

aesthetic: Rainscaping provides opportunities to beautify your landscape with blooming flowers and provides four seasons of interest in the garden.



how do you choose?

Whether you own three acres or a simple patio garden, there is a rainscape solution for your property! Drawing on horticulture, engineering and landscape architecture expertise, we have featured each of these techniques in a factsheet to help you decide which option is most suitable to your tastes, maintenance requirements and landscape condition. Whether you make a big change or a small one, you can do your part to help restore our watersheds. Visit our website at www.go.ncsu.edu/rainscaping to begin your rainscape journey.

disconnect

for rainwater dispersal

how it works:

A downspout is a vertical pipe used to drain rainwater off a roof. Downspouts from your gutters may be directed to driveways or channeled through buried pipes to street or culverts. Downspouts contribute to the heavy inflow of rainwater into the stormwater sewer system and, eventually, to nearby streams. By disconnecting your downspout and redirecting the runoff onto grass or into a garden, you can interrupt that flow. It is a simple, effective way to reduce stormwater runoff.



where will the water go?

Rainwater will flow through the downspout and onto a rock bed or into an extender that will evenly distribute rainwater into a garden or grassy area. Alternately, the rainwater can be directed into a rain barrel or cistern. Make sure the ground slopes away from the house where the disconnect occurs.

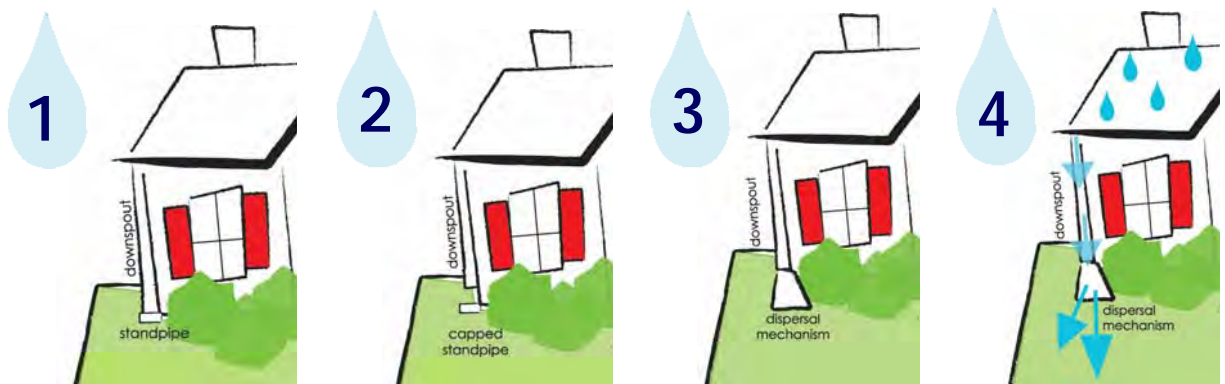
how do I disconnect correctly?

Tools you will need:

- Fine-blade hacksaw
- short sheet-metal screws
- drill
- pliers
- tape measure
- downspout elbow
- downspout extension
- rocks or splash block

An important note before you get started:

The area receiving the runoff needs to be at least 10 feet long, large enough to accept the water and allow infiltration. You may need to test this through one or two rainstorms. If you find the water runs off near a sidewalk, driveway or a neighbor's foundation, you may have to reconnect your downspout.



2

instructions:

1. Observe your site and design your disconnection.
 - A. Locate the downspout you would like to disconnect from the stormwater system. Does it lead directly into a pipe or does it flow out onto your driveway?
 - B. If it flows onto your driveway, you will direct it onto grass or into a garden area that flows away from your house.
 - C. If it connects directly into an underground drain, you will disconnect it from the drain and let water flow onto grass or into a garden area that directs water away from your house.
 - D. Locate the area that water will flow into.
 - E. Water should be allowed to drain at least six feet away from the foundation with a basement and two feet away from the foundation with a crawl space or slab.
2. Cut the existing downspout above where it enters the stormwater connection with a fine-blade hacksaw. The goal is to have room to connect an elbow and downspout extension. Some downspout extender kits come complete with the elbow. If you purchase a downspout extender kit with directions, follow those directions.
3. Attach the downspout elbow. First crimp the downspout with pliers to ensure a good fit. Attach the elbow over the downspout. Drill holes on either side and secure them together with short sheet-metal screws. Do not insert the elbow *inside* the downspout or it will leak.
4. Attach the downspout extension over the end of the elbow. Do not install the elbow *over* the extension or it will leak.
5. Direct the flow into a rock bed or onto a concrete or plastic splash diverter to help disperse the force of the water. If you use a rain barrel or cistern, the overflow should also be directed away from the house.
6. If the downspout was connected to a pipe of some sort (underground, corrugated, PVC, etc.), cap off the exposed end of the pipe.



safety considerations:

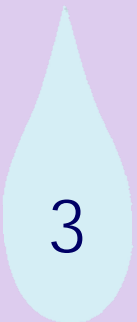
- Add or remove soil if necessary to ensure that the slope of the ground allows water to flow away from structures. However, do not disconnect downspouts on steep slopes, because of the high likelihood of erosion.
- Avoid disconnecting downspouts in an area too small for proper drainage.
- Do not add downspout extensions across a walkway, patio or a driveway to avoid tripping hazards.
- Do not disconnect a downspout within 10 feet of a retaining wall.
- Do not disconnect to areas where water sits at the surface in the winter (squishy lawns, springs, puddles).
- Do not negatively impact a neighbor's property.

resource:

Environmental Services, City of Portland, Oregon. *How to manage stormwater: Downspout Disconnection*: www.portlandoregon.gov/bes/article/378192.

collect

rainwater for capture & re-use



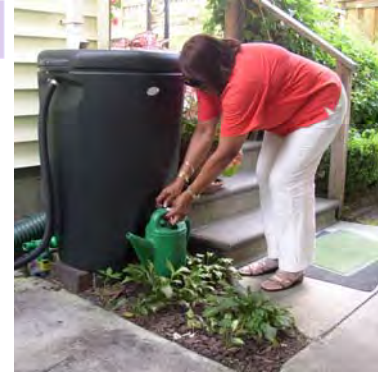
rain barrels & cisterns defined:

A rain barrel is designed to capture and store rainwater for future use. Rain barrels attach to the downspout of your stormwater gutter to capture rain that would normally become runoff. Rain barrels have a spigot at the bottom to access the water. Rain barrels often hold 40 to 70 gallons. A cistern is a rain barrel on a much larger scale, so it stores more stormwater. Cisterns could be almost any size, from 100 to 1,000 gallons or more. Cisterns are sometimes buried underground and can have a pump hooked up to them.



uses for your captured stormwater:

Rainwater captured and stored in your rain barrel can be used for outdoor water needs, such as watering plants or washing your car. Rainwater has a higher nutrient content than tap water and therefore supplies more of your plants' needs. It is *not* drinking water. Place your rain barrel where you can easily access it. Work it into your existing landscape. It is important to use stored rainwater before the next storm or the additional water will overflow. You can direct this overflow into a rain garden or onto the lawn. See the factsheets on downspout disconnection and rain gardens for more information.



instructions:

Most rain barrels come with instructions and you should follow those first. In general, all rain barrels are installed the same way and you can use the instructions here.

1. Position your barrel on level ground or level blocks, next to a downspout. Leave enough room under the spigot for a watering can. If you plan on using a hose, remember water runs downhill.
2. Cut the downspout with a hacksaw 8 to 12 inches above the top of the barrel. Remove the lower section of downspout and set the barrel in place. Attach a downspout elbow and a short section of downspout to direct water onto the screened lid of your rain barrel.
3. Attach a section of hose to the overflow fitting (some barrels come with these). If the hose that came with the rain barrel is



instructions (continued):

too short, you can use an old piece of garden hose instead. Make sure it flows away from the foundation of your house, preferably into a landscaped area or onto rocks or a splash block toward your lawn. If your home is on a steep slope, be sure to direct the rain barrel overflow into the existing drainage system or in such a way that it does not increase erosion.

4. Different types of downspout adapters are also available. These are installed along the downspout and have a hose leading to the rain barrel. When the rain barrel fills, the rainwater will bypass the barrel and continue down the downspout as it did before the rain barrel was installed.
5. A rain barrel has a spigot usually set high enough to fill a watering can. You can also attach a hose to the drain valve at the bottom of your rain barrel.
6. You can connect two or more barrels together by linking the overflow ports at the top, so one barrel flows into the next.

want more than a rain barrel can hold?

An average-sized, 65-gallon rain barrel is not large enough to capture all the runoff from your roof. A 300-square-foot roof section that drains to a downspout would produce approximately 162 gallons of water. If you use a 65-gallon rain barrel, 97 gallons of water will overflow from the barrel (hopefully into your rain garden). If you would like to capture more rain than you can with a rain barrel, see the NC Cooperative Extension publication *Rainwater Harvesting: Guidance for Homeowners*: www.content.ces.ncsu.edu/rainwater-harvesting-guidance-for-homeowners.

Here is a quick calculation for determining how many gallons of water will run off your roof from one inch of rainfall: **$V = A \times 0.6$** .

Volume = gallons of runoff, A = surface area of your roof, and 0.6 is a conversion factor for inches/feet/gallons. A general rule is 1" of rainfall on a 1,000-square-foot roof will produce 600 gallons.



where can I get one?

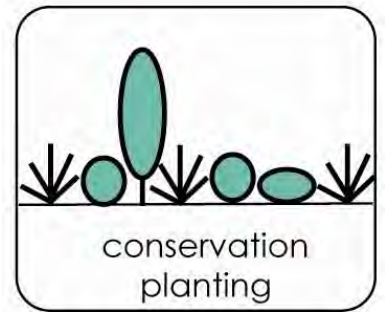
Hardware stores, and even grocery stores, now sell rain barrels. Check with your town or county to see if they are selling them. Various styles and sizes of cisterns and rain barrels can be found online at different rain barrel and rainscaping companies. You can also make your own rain barrel — many towns offer guidance on their websites. Check with your local Cooperative Extension Service for more ideas and information.

naturalize

plant for rainwater infiltration

what is naturalizing?

Naturalizing, or conservation planting, is replacing areas of turf or bare soil with a diverse mix of plants such as trees, shrubs, perennials and groundcover. Although turf areas appear to be pervious, the opposite is often true, since turf is usually placed on compacted soil after construction. That lush, green lawn probably covers an area of impervious surface. Rainwater can soak in if you remove turf, aerate and turn the soil, amend the soil where needed and add plants. Trees, shrubs and perennials also have a longer growing season than many grasses, so they actively use water at more times of the year. They also have deeper roots that can funnel more rainwater into the soil and capture it



what's wrong with my existing plants?



The problem is not in your existing plants! The problem is in the lack of diversity within the plants and the large amounts of turf grass in our residential landscapes. By increasing the diversity of your plant palette, you not only aid in rainwater remediation, but also provide habitat for birds and other wildlife that depend on plant biodiversity to survive. Conservation planting with trees and shrubs can also reduce energy bills by providing shade and wind protection to your home. Replacing just some of your turf with other plants provides benefits.

How do I turn a turf area into a conservation planting?

Remove turf and amend the soil with organic material to break up compacted soil. The ideal amount of organic soil amendment is 25-50 percent by volume. Choose plants suitable for the location, cover bare areas with mulch and maintain the area to meet your own landscaping goals. Conservation areas can be actively managed for a manicured look, or left to grow more informally depending on your tastes.



maintenance:

Like any new landscape, conservation landscapes will require some upkeep, but maintenance is usually lower in the long run and less costly to your wallet. The new plants will need watering and monitoring during the first season until they become established. Disturbed soil is often prone to invasion by weeds and a planted area may require some weeding. A three- to four-inch layer of mulch will help curb weed growth, as well as conserve moisture between waterings. In time, a conservation landscape will require less watering than a lawn. Plants will spread to fill gaps and natural cycles help with pest control. Garden maintenance is reduced to seasonal cleanup and occasional weeding or plant management. The savings realized by using few or no chemicals, less water and less gas for a mower, can more than make up for initial costs of installing the landscaping.

what do I plant?

When it comes to the plants, it is important to avoid invasive species. Not only are we trying to aid in alleviating stormwater problems, but also aid in the restoration of natural environment. The simple addition of a new planting bed can do both! While you are planning the layout, remember to think in layers. Consider having a tree layer, an understory (shrub) layer and a lower (groundcover) layer. More layers mean more surface area of plant material, which increases stormwater capture and provides various niches for animals, such as birds and butterflies. Many of our common landscape plants are not the best options for conservation plantings. The following table provides a list of replacements for the commonly “misused” plants.

instead of:

try:



Nandina

Inkberry, winterberry, chokeberry, American holly

Bradford pear

Yellowwood, native magnolias, serviceberries

Miscanthus grass

Switchgrass, Indian grass, purpletop, pink muhly grass

Japanese honeysuckle

Trumpet honeysuckle, cross vine

Privet

Blackhaw, rusty blackhaw, Indian cherry, native dogwoods

Russian olive (*Elaeagnus angustifolia*)

Fringe tree, devilwood, buckeyes, serviceberries

Autumn olive (*Elaeagnus umbellata*)

Witch hazel, chokeberry, wild plums

English ivy

Virginia creeper, wild ginger, Solomon’s seal, woodland aster

Burning bush

Possumhaw, Virginia sweetspire, witch alder

Barberry

Virginia sweetspire

Fragrant honeysuckle

Spicebush, arrowood viburnum, witch alder

resources:

U.S. Fish & Wildlife Service: Native Plants for Wildlife Habitat and Conservation Landscaping: www.fws.gov/chesapeakebay/pdf/NativePlantsforWildlifeHabitatandConservationLandscaping.pdf

Landscaping for Wildlife with Native Plants, NC State University: content.ces.ncsu.edu/landscaping-for-wildlife-with-native-plants

garden

for rainwater absorption & filtration



what is a rain garden?

Rain gardens are slightly recessed gardens designed to capture and temporarily hold rainwater flowing through your yard. Think of them as a sponge, absorbing rainwater with a modified soil bed. In addition to providing a place for rainwater to be used by plants, they slow down and lessen the amount of water that runs into creeks. Rain gardens also filter water, which is important because stormwater runoff can contain pollutants such as fertilizers, pet waste, road runoff and even atmospheric nitrogen from rain and roof runoff. While the rain garden is a bit more labor intensive than a rain barrel or a conservation planting, it provides the greatest number of benefits, when it comes to residential stormwater management.



but what about...?

Common myths associated with rain gardens, dispelled!

myth:

Rain gardens are weed patches.

Rain gardens will breed mosquitoes.

Rain gardens require more maintenance than other gardens.

Rain gardens do not work in clay soils.

Rain gardens are comprised of water-loving plants.

fact:

⇒ Rain gardens can and should be as attractive as any other garden space!

⇒ Rain gardens will only be flooded for 1-2 days maximum after a rain event. Mosquitoes need 7 days to hatch eggs.

⇒ Rain gardens require no more maintenance than other gardens and sometimes require less!

⇒ Rain gardens can work in any kind of soil because of the organic material that is added to the filter bed.

⇒ Actually, plants in a rain garden must be able to thrive in dry periods and wet weather equally.

How can I get one?

Unlike a rain barrel, you can't order a rain garden online. This set of factsheets will teach you to size, design, plant and construct your rain garden. We have taken out the complicated part and made it as simple as possible for you to have a beautiful rain garden in your own yard!

rain gardens of all shapes, sizes and locations:

front yards & backyards:



parks & offices:



streetscapes & parking lots:



sources of runoff:



your roof

your driveway

your neighbor

determining your impervious surface:

Rain gardens are designed to hold runoff. Most of this runoff comes from the impervious surfaces at your home. Some even comes from your lawn, which is not as pervious as you might expect. That is why replacing lawn with conservation plants and rain gardens is such an effective stormwater management tool.

A rain garden is designed to hold water for a day or so. You may not have enough area to hold all the water you want and that is fine, as long as the overflow berm is stabilized with rocks and/or plants. The larger the rain garden area, the more runoff it will catch. The deeper the rain garden, the more runoff it will catch also. Any size rain garden is better than no rain garden.

So, how big do you need your rain garden to be? That depends on how much impervious surface area you have draining to it. In the example below, we will look at a simple roof with one peak.

Step 1: Calculate the area of your roof producing runoff you wish to capture in a rain garden.

The highest priority downspouts to capture in a rain garden are those that drain most directly to the stormwater system. The roof usually drains to a gutter and the gutter will run to downspouts. If you have two downspouts at either end of the gutter, you can assume half of the roof runoff goes to one and half to the other. Using our example on the next page, half the roof drains to the front yard and half of that drains to each downspout. We will direct runoff from one downspout to the rain garden.

The total roof area of a home is approximately the same square footage as your one-story home or the first floor of your multi-story home (although the roof area is actually greater than the area of the floor below it, because it is on an angle).

To calculate square footage, multiply length by width. Our example home has one peak in the middle of the house, so half the roof drains to the front and half drains to the back. So, you will divide the entire roof area by two. Now, you have the amount of water that will drain down the

front of your house. Because you have a downspout on each end, divide that number by two to get the amount of area that will direct rainwater to one of the downspouts and into the stream unless the rainwater is captured.

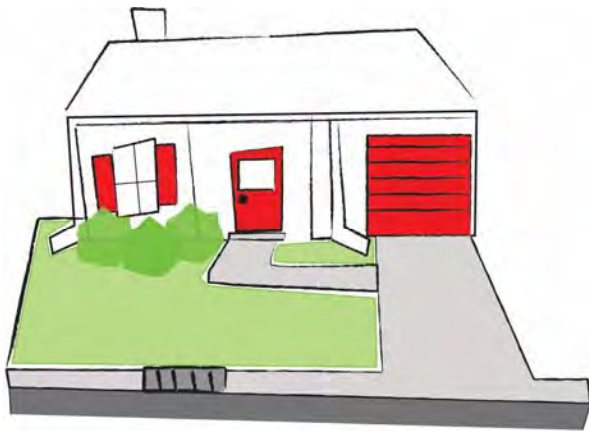
Step 2: Calculate the area of any concrete or other impermeable surface, such as driveway, walkways, out-building roofs, etc. that contributes to runoff leading to your rain garden. Multiple the length and width of each surface and add all the surfaces together.

Step 3: Add these two areas together. The area of the roof (Step 1) + the area of all the other impervious surfaces (Step 2) will give you the area in square feet that will contribute runoff to your rain garden.

Step 4: Convert the area from Step 3 into rain garden size. Use an average storm with 1 inch of rainfall. This means the rain garden should be sized to store and treat 1 inch of rain falling on the impervious areas leading to the rain garden. Construct your rain garden to be different depths, such as 3, 4 or 6 inches deep. The deeper it is, the smaller the surface area needs to be to hold the same amount of water (technically, we are determining the volume of the rain garden). The simplest way to determine the final area of a rain garden is to divide the area to be treated by the depth of the final garden. So, if you want to store and treat 600 square feet in a 6-inch-deep rain garden, divide the area from Step 3 by 6. That gives a 100-square-foot rain garden, which can be 10' x 10' or 5' x 20' or approximately 12' x 8'.

area of rain garden (sq ft) = area to be treated (sq ft) / depth of rain garden (in)

example:



Here is a roof that pitches in two directions. The problem area is in the front yard, where runoff quickly exits the property and flows into a storm drain.

- Total roof area = 1,000 square feet (sq. ft.)
 - Front half of roof = 500 sq. ft.
 - Driveway + Walkway = 400 sq. ft.
 - Total Impervious area = 900 sq. ft.
 - If one 6-inch-deep rain garden could capture it all, divide the impervious area by 6: $900/6 =$ a 150 sq. ft. rain garden
-
- A 150 sq. ft. garden could be 10' x 15', 5' x 30', approximately 12' x 12' or about a 14' circle.
 - BUT, this house does not drain all to the same place. Approximately half the roof drains to the left. You could build a rain garden for that 250 square feet of rainwater (half the front of the roof).

resources:

Three Rivers Rain Garden Alliance: raingardenalliance.org/right/calculator

NCSU Extension rain garden publications: chatham.ces.ncsu.edu/rain-gardens

location, location, location:

The best location for a rain garden is between the source of the runoff and the point where it enters the stormwater collection system. The entrance to the stormwater collection system could be your driveway, the street or maybe a yard inlet. Place a rain garden at least 10' down slope from a house foundation, 25' from a septic field and 50' from a well head. If you have a well or septic tank, check your local ordinances to be sure. A rain garden is not suitable for the low wet spot in your yard. You want your rain garden to drain. Consider how your rain garden will relate to the other planting beds in your yard. The new garden can be absorbed into existing beds or it can stand alone. If it stands alone, relating the shape of the rain garden to your existing garden beds will help with a more cohesive look for your landscape.



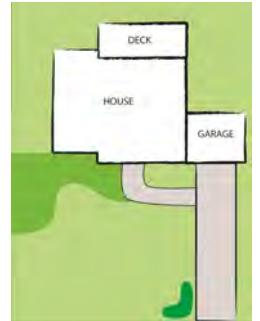
within
existing
bedlines



alongside
existing
bedlines



free
standing



your style, your rain garden:

Our landscapes are unique representations of us — and your rain garden can be too! Gardens are generally informal or formal and a rain garden can be either as well. A formal garden is precise and symmetrical. An informal garden is one with sweeping, gently curved, organic bedlines; asymmetrical plantings or groupings; and natural plant forms.

water in, water out :

The size of your rain garden was determined using an average storm with one inch of rainfall, so if you need to make it slightly bigger or smaller, that is fine. It will either hold a little more or a little less runoff. The garden will have an inflow area where runoff will enter and an outflow area on the downhill side, in case you receive more than an inch of rainfall at a time. Identify the inflow and outflow areas when laying out your rain garden.

the ease of planting design:

When it comes to the composition of your rain garden, there are some key considerations to remember before deciding what to plant.

design considerations:

- Consider the adult size of the plant and space accordingly when planting.
- Plant in odd numbers, unless the individual plants will grow together to form a mass, then the mass of plants will be treated like one plant. BUT, don't get too carried away with the odd numbers!
- Mix up the composition numbers for visual interest.

Overlap your plant masses. This keeps your design visually appealing by simply overlapping the ends of masses so that your plant groupings “hug” each other.

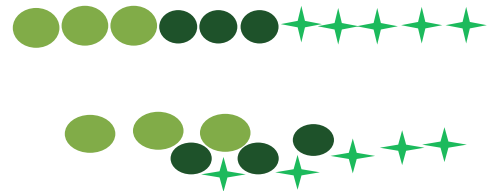
instead of:



try:



viewed from above



Limit the number of single specimens in your garden. Specimen plants should be used sparingly to create interest in your garden.

instead of :



try:

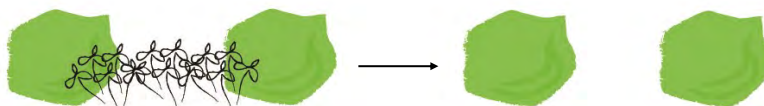


A background of evergreens sets the stage for deciduous shrubs and perennials. This also insures that you will have something of interest in your garden even in the winter months.



No mass of perennials should be big enough to leave a gaping hole in the winter. Remember to layer them with your woody plants/shrubs for year-round interest.

spring/summer:



fall/winter:

Add something for every season. Plants provide interest in every season — from blooms in the spring, to fruit in the summer, to foliage in the fall — so remember to utilize all the seasonal characteristics!

spring



summer



fall

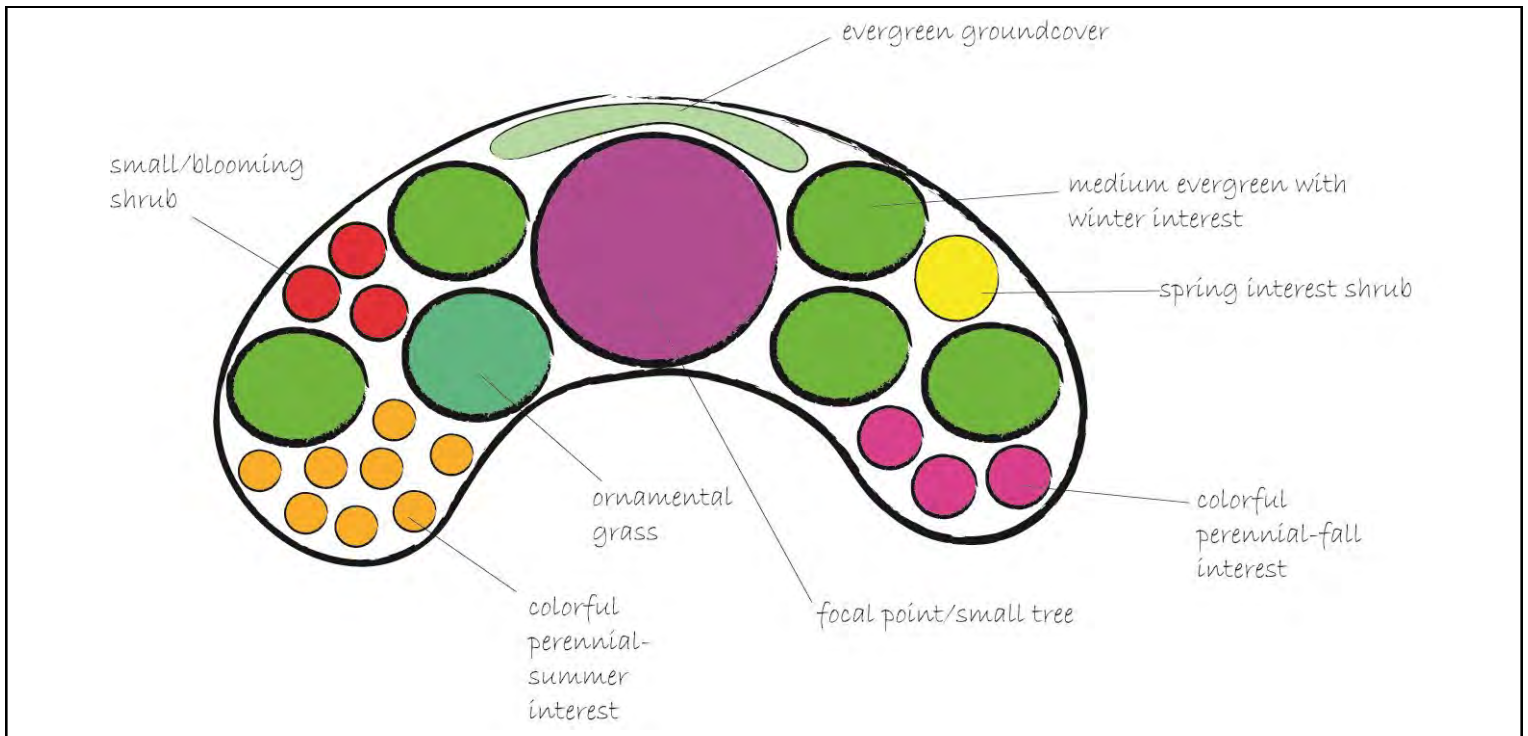


winter



sketch out your planting plan:

Your planting plan will be a map of your plants. Sketch it like you are looking at it from the sky. Start with design qualities such as shape, habit, size, foliage, color and texture. Then, choose the plant based on the characteristics, such as sun or shade requirements and whether sure it can withstand prolonged dry conditions with occasional wet periods for a few days. If you don't find that exact plant in the store, you can find something that fits those characteristics. The sketch doesn't have to be fancy. Remember: Your bed outline should relate to the surrounding landscape lines, which may be a circle, square, rectangle, oval, triangle or may be long and curvy or small and linear.



now you try it:

1. Start with the garden outline. Note the location (sun, shade, partial shade).
2. Draw circles representing plants of varying sizes to create visual interest.
3. Label the circles with design qualities you want.
4. Find plants exhibiting those design qualities.

Use the grid on the next page to sketch out your garden. It is a one-inch grid. Each inch represents one foot on the ground. For a larger garden, you can make each inch equal two feet.

source:

Anne Spafford, Department of Horticultural Science, NC State University

resource:

Helen Kraus and Anne Spafford. *Rain Gardening in the South: Ecologically Designed Gardens for Drought, Deluge and Everything in Between*. Eno Publishing. 2009

sketch your rain garden

1 inch = 1 foot



construct

your rain garden

in the simplest terms, you will:

1. dig a hole, 2. aerate the soil, 3. amend the soil, 4. plant plants, 5. enjoy

tools you will need:

shovels, tarp, rake, rocks, plants, garden hose or rope, flags or spray paint

first things first:

1. Call 811

811 is a free service that identifies and marks underground utilities like cable, phone, electricity and gas lines. Always determine where utility lines are located BEFORE you dig! You may need to change the location or design of your rain garden to avoid utility lines. Call 811 at least a week in advance. Dial 811 or visit www.call811.com.



next steps:

2. Infiltration test

Before beginning your garden, do an infiltration test to be sure that water will infiltrate into the surrounding soil in just a few days.

- Locate where you would like your rain garden.
- Dig a hole 24" deep and 12" wide.
- Fill it with water.

If it takes more than 36 hours to drain, the site is not appropriate for a rain garden. If you hit the ground water table while you are digging the hole, the site is also not appropriate for a rain garden.



3. Outline your rain garden

Use a garden hose or some rope to lay out the shape of your garden. The size you determined for your rain garden was for a rectangle, so lay out the rectangle first, then move the length of hose around to the shape you want. The inside area will be close enough to the original rectangle you

the steps (continued):

measured. Step back, take a look and move it some more until you are happy with the shape. You may want to let it sit there for a day or two, so you can get a feel for how it will look in your landscape. Once you have the shape you want, you can mark it with marking paint or flags. Remember, the size was determined using one inch of rainfall, so if you need to make it slightly bigger or smaller, that is fine. It will either hold a little more or a little less runoff. The garden will have an inflow area where runoff will enter and an outflow area, in case you receive more rain than the garden is designed to hold. Identify these two spots when laying out your rain garden. This is where you will incorporate some rocks.



4. Remove any turf

Remove the turf in thick sheets. Save some to use on your berm. Use the rest elsewhere to patch up parts of your lawn, or compost it.

5. Use a tarp

Lay a big tarp on the ground next to the garden, where you will place excavated soil. More than one tarp comes in handy.

6. Dig

When you sized your rain garden, you determined how deep it would be. Remove that many inches of soil, plus three inches to account for mulch. So if you sized your rain garden for six inches deep, remove nine inches of soil. If you removed high-quality topsoil, you can dig an inch or two deeper and put back in that much topsoil. You may use some of this soil to build a berm and work it in other areas of the yard. Rough up the remaining soil with a shovel about six inches deep, to aerate and loosen it. Slope the sides of your rain garden and think about where your inflow and outflow will be.



resources:

- NC State University Extension rain garden publications: chatham.ces.ncsu.edu/rain-gardens.
- City of Durham rain gardens: durhamnc.gov/787/Rain-Gardens.
- NC State provides residential rain garden instruction and certification. Find a list of certified professionals here: www.bae.ncsu.edu/workshops-conferences/rg-201.
- Ask your local garden store or nursery for ideas, especially on design and plant choice.

the steps (continued):

7. Amend the soil.

Ideally, you will determine the kind of soil you have. Your county's Cooperative Extension office can test soil samples for free and provide information for improving soil for plant success. Clay soil infiltrates water very slowly. Soil amendments help improve drainage, reduce pollutant levels and support plant growth. Add soil amendment to the garden hole and mix it in with the loosened soil. One standard is to aim for at least



25 percent soil amendment. Pine bark fines (pea-sized nuggets) or leafy compost are good choices. Make sure the final depth of the rain garden bed is a little deeper than you intended, to account for mulch. If six inches of ponding is desirable, the final bed will be about nine inches deep.

The depth of your garden, the aeration of the soil and the addition of amendment should result in a rain garden bed that supports plants, allows water to soak into the ground and also holds some ponding water.

8. Build a berm

If your rain garden is on a slope, use some of the excess soil to create a berm that is 3-6 inches taller than the garden bed on the downhill end of the rain garden. This allows the rain garden to retain water during a storm. The height of the berm will determine how much water is held in the garden.



9. Stabilize your inflow and outflow

The inflow point, where water enters your garden, can experience extreme water-flow conditions during rainfall events. Use rocks to help dissipate and disperse the energy of the flowing water. Excess water that does not fit in the rain garden will flow over the lowest point of the berm, called a weir. The weir should be at least a foot wide and a few inches lower than the berm. Decide where this will be and use rocks and plants to help stabilize this area.

10. Plant!

You can now plant your plants. You can also split up this project over a few days and plant in the following days. If it rains, water will flow into the rain garden and you might even decide to change the berm or inflow area before you plant.

the steps (continued):

11. Mulch

Add three inches of mulch. Triple shredded hardwood mulch is less likely than other varieties to float during a rain event. Mulch protects plants from extreme temperatures, keeping the soil cooler in summer and warmer in winter. It limits evaporation from the soil, holding moisture for plants. It also helps stop weed seeds from sprouting.

12. Maintain

Water your rain garden in the first year to help the plants get established. After that, it should only need watering during droughts. Weed as needed. Replace the mulch every two to three years. With some care, your garden will stay beautiful for years to come.

what rocks?

Rocks are used to slow the flow of water entering and leaving a rain garden. You can use rocks you find around your yard or purchase fancier rocks. The rocks help slow down the water, so it does not erode the edges of the rain garden. You can also use rocks to channel water from your downspout to your rain garden.



a rain garden is just that — a garden!

It should be beautiful and have four seasons of interest. Many gardens rely solely on perennials. This looks nice in the summer, maybe the fall, but often looks barren come winter. A well-designed garden looks nice in all seasons. Use a combination of woody plants (evergreen and deciduous) and perennials. Of course, weeding and mulching are necessary to maintain any garden.

what to plant?

Plants in a rain garden need to be both drought tolerant and able to withstand short periods of flooding. The plants may not flower and grow as much during times of water stress, but they will flower again and resume growing when the stress is removed. Rain garden plants are more than just tough, they absorb water and nutrients, removing pollutants before they end up in our water supplies. Also, they add beauty to our landscapes with their flowers and foliage.

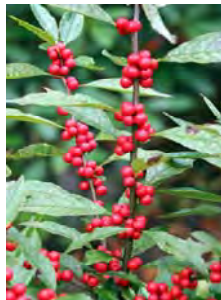
sun vs. shade?

When locating your rain garden, take note of the surrounding light conditions. Does the area stay in full sun or shade? Does it receive a bit of both? This will help determine which type of plants you will need. A sun garden receives at least six hours of sunlight per day, while a shade garden receives practically none. Many plants will do well in between these two ends of the continuum. We list the plants as **sun**, **part sun**, **shade** or a range between these three.

native vs. non-native?

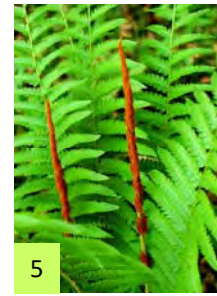
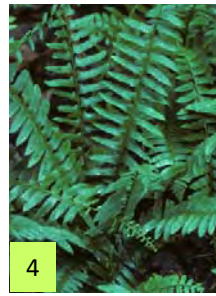
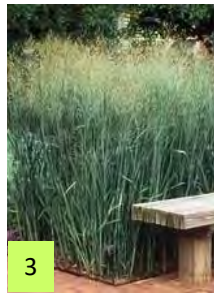
There are reasons for both:

- Natives are preferable if providing wildlife habitat is a goal.
- Our developed landscapes may not meet the soil and temperature needs of some natives.
- Avoid invasive, colonizing or thicketing plants, whether native or non-native.



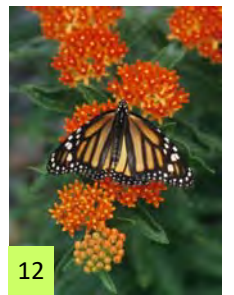
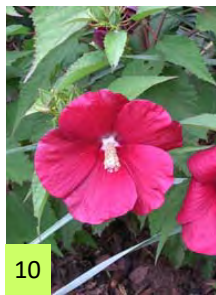
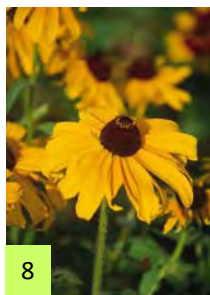
the plants:

The plants on the following pages are just a sampling of rain garden plants. Please use the resources section to locate hundreds and thousands more plants, many of which have multiple varieties. A **deciduous** plant will lose its leaves in the winter, while an **evergreen** plant will hold its leaves throughout the year. **Perennials** usually die back to the ground during the winter, but will come back in the spring. **Dimensions are given as height x width** (height alone for groundcovers and vines). The non-native plants are underlined.



perennials:

1. River oats ♦ *Chasmanthium latifolium* ♦ **sun to shade** ♦ perennial grass (winter interest) ♦ 3' x 2'
2. Muhly grass ♦ *Muhlenbergia capillaris* ♦ **sun** ♦ perennial grass (winter interest) ♦ 3' x 3'
3. Switch grass ♦ *Panicum virgatum* ♦ **sun** ♦ perennial grass (winter interest) ♦ 3' x 2'
4. Christmas fern ♦ *Polystichum acrostichoides* ♦ **part sun to shade** ♦ semi-evergreen (winter interest) ♦ 2' x 2'
5. Cinnamon fern ♦ *Osmunda cinnamomea* ♦ **part sun to shade** ♦ perennial ♦ 3' x 3'
6. Carolina phlox ♦ *Phlox carolina* ♦ **sun** ♦ perennial ♦ 36" x 18"
7. Coneflower ♦ *Echinacea purpurea* ♦ **sun** ♦ perennial ♦ 2-3' x 2' (in many colors)
8. Black-eyed Susan ♦ *Rudbeckia fulgida* ♦ **sun** ♦ perennial ♦ 18-30" x 2' (also other species of varying heights)
9. Narrow-leaved sunflower ♦ *Helianthus angustifolius* ♦ **sun** ♦ perennial ♦ 4-8' x 3-4'
10. Rose mallow ♦ *Hibiscus moscheutos* ♦ **sun to part sun** ♦ perennial ♦ 3' x 4' (also 6' tall *H. coccineus*)
11. Siberian iris ♦ *Iris sibirica* ♦ **sun to part sun** ♦ perennial ♦ 2-3' x 1'
12. Milkweed ♦ *Asclepia tuberosa* ♦ **sun** ♦ perennial ♦ 2-3' x 2'

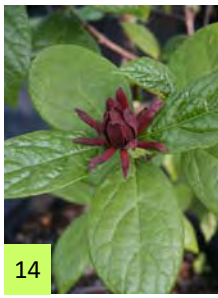


resources:

U.S. Fish & Wildlife Service: Native Plants for Wildlife Habitat and Conservation Landscaping: www.fws.gov/chesapeakebay/pdf/NativePlantsforWildlifeHabitatandConservationLandscaping.pdf.

NC State University Cooperative Extension: Landscaping for Wildlife with Native Plants: content.ces.ncsu.edu/landscaping-for-wildlife-with-native-plants.

NC State Cooperative Extension rain garden plants: extensiongardener.ces.ncsu.edu/extgardener-rain-garden-plant-list.

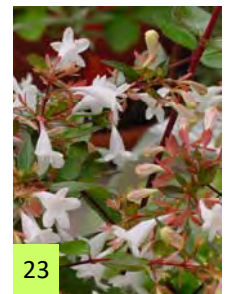


shrubs — deciduous:

13. American beautyberry ♦ *Callicarpa americana* ♦ **sun to shade** ♦ deciduous ♦ 8' x 6'
14. Sweet Betsy ♦ *Calycanthus floridus* ♦ **sun to shade** ♦ deciduous ♦ 8' x 10'
15. Summersweet clethra ♦ *Clethra alnifolia* ♦ **sun to part sun** ♦ deciduous ♦ 8' x 6'
16. Smooth hydrangea 'Annabelle' ♦ *Hydrangea arborescens* ♦ **part sun to shade** ♦ deciduous ♦ 5' x 6'
17. Oakleaf hydrangea ♦ *Hydrangea quercifolia* ♦ **sun to part sun** ♦ deciduous ♦ 10' x 12'
18. Virginia sweetspire ♦ *Itea virginica* ♦ **sun to part sun** ♦ deciduous ♦ 6' x 7'

shrubs — evergreen:

19. Yaupon holly ♦ *Ilex vomitoria* ♦ **sun to part sun** ♦ evergreen ♦ 10-15' x 8-10'
20. Inkberry holly ♦ *Ilex glabra* ♦ **sun to part sun** ♦ evergreen s 5' x 5'
21. Anise ♦ *Illicium floridanum* ♦ **sun to part sun** ♦ evergreen ♦ 10' x 8'
22. Southern wax myrtle ♦ *Myrica cerifera* ♦ **sun to part sun** ♦ evergreen ♦ 10-15' x 10-15'
23. Abelia ♦ *Abelia grandiflora* ♦ **sun to part sun** ♦ semi-evergreen ♦ 3-6' x 3-6'
24. Doghobble ♦ *Leucothoe axillaris* ♦ **sun to part sun** ♦ evergreen ♦ 2-4' x 3-5'

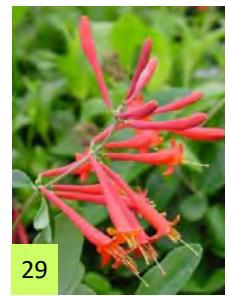
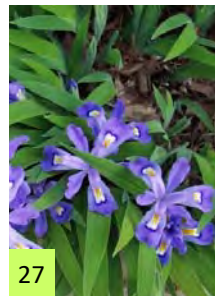
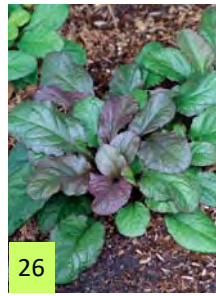
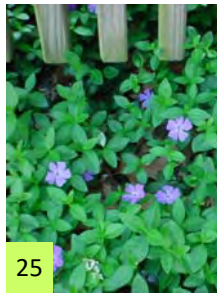


resources:

Use an online search engine, like Google or Bing, to find images of many different species.

Find more information on plants at:

- NC Extension Gardener Plant Toolbox: <https://plants.ces.ncsu.edu>.
- USDA Plants Database: plants.usda.gov.

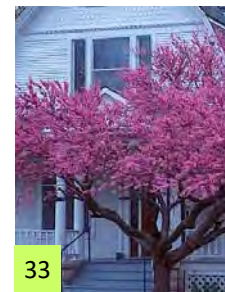
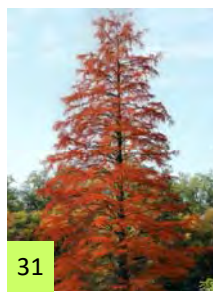
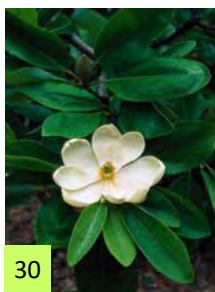


groundcovers and vines:

- 25. Periwinkle ♦ Vinca minor ♦ **part sun to shade** ♦ groundcover ♦ evergreen ♦ 4-6" tall
- 26. Bugleweed ♦ Ajuga reptans ♦ **sun to shade** ♦ groundcover ♦ evergreen ♦ 3-6" tall
- 27. Dwarf crested iris ♦ Iris cristata ♦ **sun to part sun** ♦ groundcover ♦ deciduous ♦ 6" tall
- 28. Carolina jessamine ♦ Gelsemium sempervirens ♦ **sun to part sun** ♦ vine ♦ evergreen ♦ 10-20'
- 29. Trumpet honeysuckle ♦ Lonicera sempervirens ♦ **sun to part sun** ♦ vine ♦ semi-evergreen ♦ 15-25'

trees:

- 30. Sweetbay ♦ Magnolia virginiana ♦ **sun to part sun** ♦ tree ♦ evergreen ♦ 60' x 30'
- 31. Bald cypress ♦ Taxodium distichum ♦ **sun** ♦ tree ♦ deciduous ♦ 70' x 40'
- 32. Fringe tree ♦ Chionanthus virginicus ♦ **sun to part sun** ♦ tree ♦ deciduous ♦ 20-30' x 20'
- 33. Red bud ♦ Cercis canadensis ♦ **sun to part sun** ♦ tree ♦ deciduous ♦ 20-35' x 30'



room for trees:

If you have room to plan for a tree in your garden's future, you can plant it now and let it take the place of a shrub until it matures. Many trees will do great in a rain garden. You can plant perennials and shrubs with it and plan to remove them in the future. Like the many colors and sizes of perennials, some trees have been bred to grow smaller than their wild cousins.