

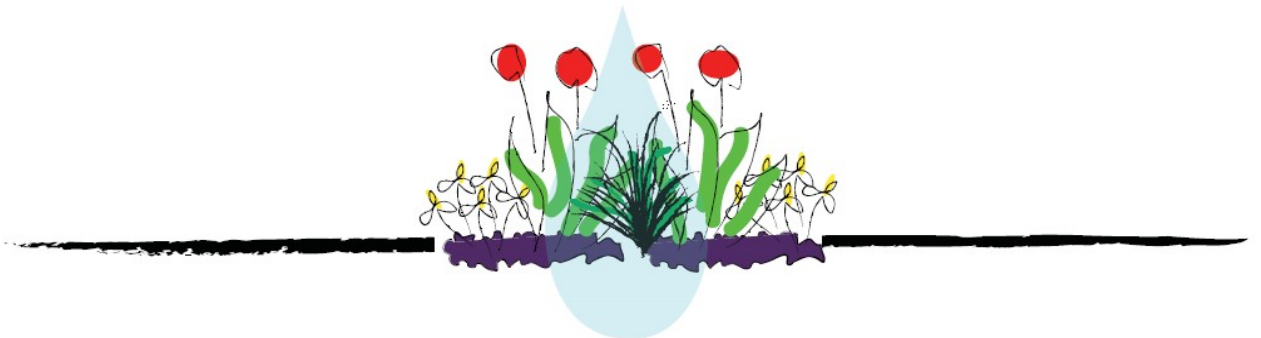
stormwater . gardening
simple . valuable . artistic
expressive . beneficial . easy

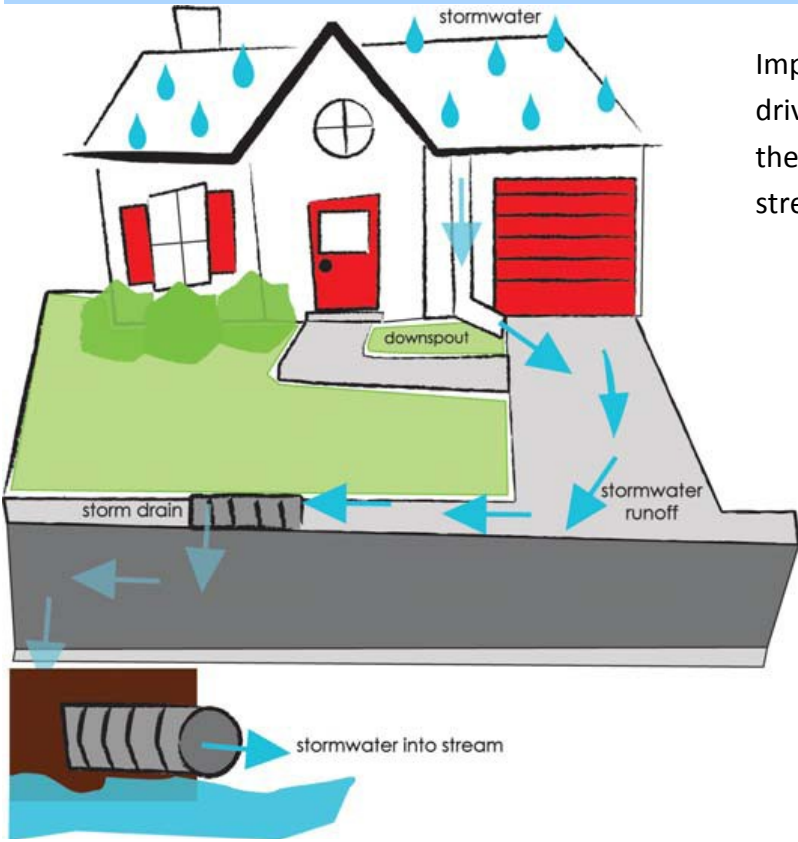
a beautiful solution to stormwater pollution

know your rainscaping

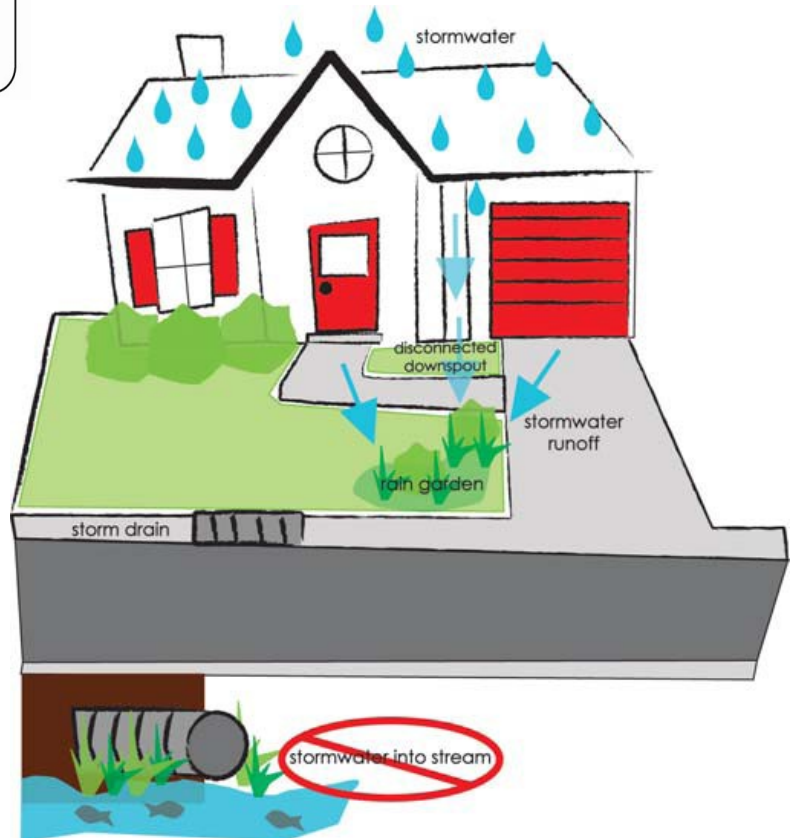
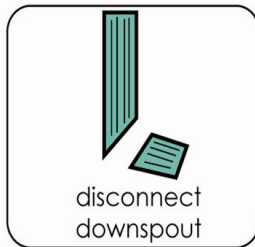
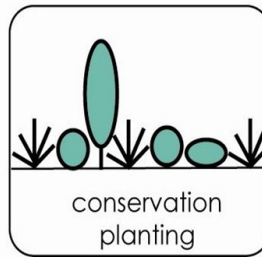
This series of factsheets provides an overview of rainscaping: the purpose, the techniques, and the benefits of adding landscape enhancements to reduce stormwater runoff.

Use the factsheets to help you incorporate rain into your landscape.





Impervious surfaces (hardscape) like roads, sidewalks, driveways and roofs prevent rain from infiltrating 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 habitat.

the stormwater issue:

Impervious surfaces (hardscape) like roads, sidewalks, driveways and roofs prevent rain from infiltrating into the ground. If rainwater cannot infiltrate soft ground, it races downhill collecting pollutants, and eroding our landscapes along the way. The additional volumes of water, sediment, and pollutants are then emptied into streams and tributaries disrupting habitats downstream. You can make a difference 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 stormdrain. Stormdrains flow to creeks. This stormwater runoff carries pollutants, causes flooding, erodes streambanks and disturbs habitat.

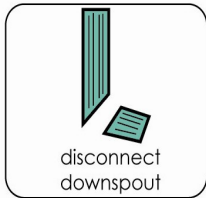
In contrast, rainfall on natural surfaces like gardens, forests and meadows soaks into the ground, replenishing groundwater and streams, and providing water for plants. Rainscapes simulate natural drainage to intercept, capture and absorb rain.

This series of factsheets will provide the detail needed to rainscape your backyard.

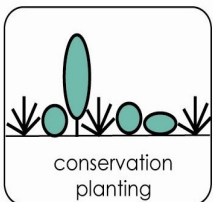
rainscaping techniques defined:



Rain Barrels Capture rainfall coming off roofs, gutters and downspouts. They store rainfall to use in the garden at a later date and 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, amending or aerating the soil, or planting trees, shrubs or perennials, more rainwater can be absorbed into the ground and used by the plants, 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 not only irrigates the plants, but will have most of the pollutants removed from it (partly by the plants and partly by the filter bed).

how to decide which one is best for you?

The great thing about rainscaping is that there are different techniques that can all suit the needs of you and your landscape best. For instance, if you live in townhome with little 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, the most “bang for your buck”. They not only remove stormwater, they filter it and provide beautiful scenery within your landscape. Some homeowners find a combination of the techniques is the best solution, such as a rain barrel and rain

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.

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



how do I choose?

Whether you own 3 acres or a simple patio garden, there is a rainscape solution for your property! Drawing on horticulture, engineering, and landscape architectural expertise, we have featured each of these techniques in a series of guides to help you decide which option is most suitable to your tastes, maintenance requirements and landscape conditions. So no matter, big or small, you can help do your part to restore our watersheds. Visit our website at www.ncsu.edu/WECO to begin your rainscape journey.

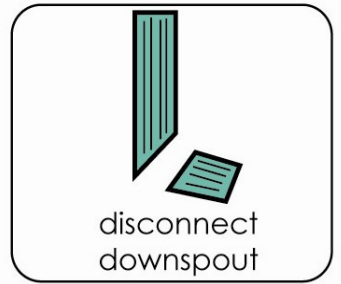
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disconnect

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 directly to driveways or channeled through buried pipes to street or culverts. Downspouts contribute to the heavy influx 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 the rainwater will infiltrate into the ground more readily, reducing runoff to the stream. It is a very simple, yet effective way to reduce stormwater runoff. Downspouts can also be directed into rain barrels or cisterns.



where will the water go?

Through careful, but simple design solutions, water will be dispersed throughout a chosen area of your landscape. Don't worry, it is not going to erode or disrupt your landscape if done properly! 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 rainbarrel or cistern. Downspout disconnections should empty and have room to flow for at least 6 feet before contacting the nearest driveway or sidewalk to allow for as much infiltration as possible. Make sure the ground slopes away from the house where the disconnect occurs.

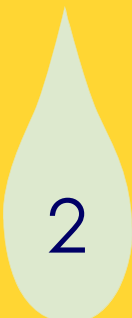
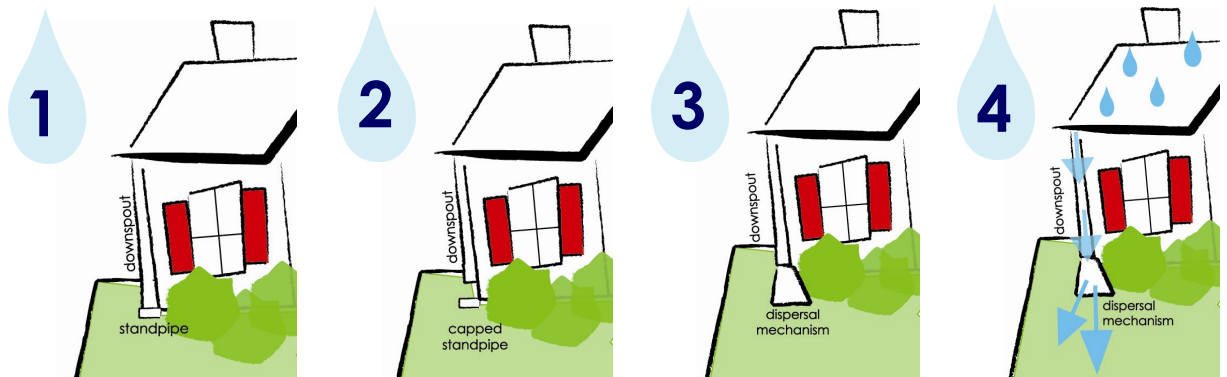
how do I disconnect correctly?

First, you will need the right supplies:

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

- An important note before you get started:

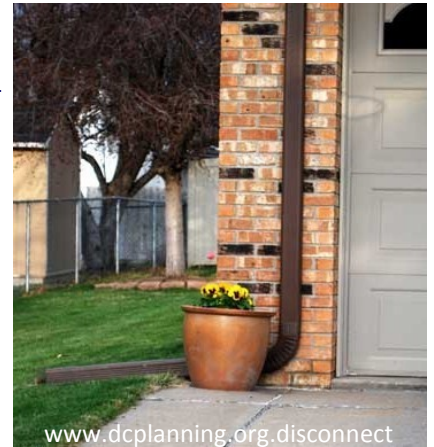
The area receiving the runoff needs to be large enough to accept it before allowing it to runoff. You may need to test this through one or two rainstorms. If you find the water runs off near a neighbors foundation or sidewalk, you may have to reconnect your downspout.



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 it flow onto grass or into a garden area that flows 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 2 feet away from the foundation with a crawl space or slab.
2. Cut the existing downspout approximately nine inches above where it enters the stormwater connection, (or about 16 inches above the ground) with a fine blade hacksaw.
3. Attach the downspout elbow. First crimp the downspout with pliers to ensure a good fit. Attach the elbow over the downspout, drills holes on either side and secure them together with short sheet metal screws. Do not insert the elbow up 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. (Some downspout extenders come complete with the elbow.)
5. If you purchase a downspout extender kit with directions, follow those directions.

Direct the flow into to a rock bed or stone, concrete or plastic splash diverter to help disperse the force of the water. If a rain barrel or cistern is used, 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.
- Avoid adding downspout extensions across a walkway, patio, or a driveway to avoid tripping hazards.
- Do not disconnect a downspout within ten feet of a retaining wall.
- Don't disconnect to areas where water sits at the surface in the winter (squishy lawns, springs, puddles)
- Take care not to negatively impact a neighbor's property.

resources:

Environmental Services, City of Portland, OR. *How to manage stormwater: Downspout Disconnection.* www.portlandonline.com
 Environmental Protection, Montgomery County, MD. *Disconnecting Downspouts.* www.montgomerycountymd.gov

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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 the water that would normally disperse into your yard or down your driveway. When it comes to time to use your water, you simply turn on the spigot at the bottom of the barrel. Rain barrels often hold 40-70 gallons. A **cistern** is a rain barrel on a much larger scale so it stores more of your stormwater. Cisterns could be almost any size, from 100 to 1000 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. Basically, anything you would use your garden hose for, except drinking. Cisterns can be used for flushing toilets or irrigation. Remember to locate your rain barrel or cistern where it can be easily accessed, and to work it into your existing landscape layout. It is important to use stored rainwater before the next storm or all of the additional water will overflow. You can direct this overflow into a rain garden or onto the lawn. Please see the factsheets on downspout disconnects and rain gardens for more information.



instructions:

1. 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. 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. The higher the rain barrel, the more water pressure you will have.
2. Cut the downspout with a hacksaw eight 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.



Instructions (continued):

3. Attach a section of hose to the overflow fitting (commercially sold rain barrels often supply all necessary parts). If the hose that came with the rain barrel is short, you can use an old piece of garden hose. Make sure it flows away from the foundation of your house, preferably into a landscaped area or onto rocks or a splash block to your lawn. If your home is on a steep slope be sure to direct the rain barrel back 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 runoff 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 a rain barrel, see the NC Cooperative Extension publication *Rainwater Harvesting: Guidance for homeowners*. <http://www.ncsu.edu/WECO/documents/WaterHarvestHome2008.pdf>



A quick calculation for determining how many gallons of water runs off your roof from a 1 inch storm is **$V = A \times 0.6$** . Volume = gallons of runoff, A= surface area of your roof, and 0.6 is a conversion factor for inches/feet/gallons. A general rule of thumb is 1" of rainfall that falls on a 1000 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 - many contract with companies to sell them at a reduced rate. 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 web sites.

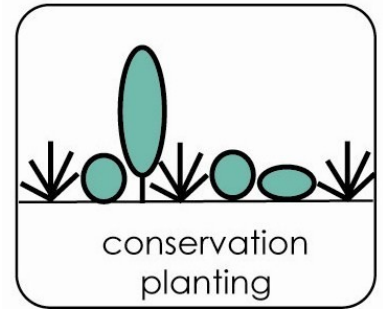
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naturalize

plant for rainwater infiltration

what is naturalizing?

Naturalizing or conservation planting is replacing areas of turf and bare soil with a diverse mix of plants such as trees, shrubs, perennials, and groundcovers. Although turf areas appear to be pervious, the opposite is true. Since turf is often placed on compacted soil after construction, that green, lush lawn covers an area of impervious surface. By removing turf, aerating and turning the soil, amending the soil and adding plants, rainwater can be better absorbed. 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 capture more rainwater, and funnel more rainwater into the soil.



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 that accommodate our residential landscapes. By increasing the diversity of your plant palette, you not only aid in rainwater remediation, but provide habitat for birds and other wildlife that depend on biodiversity of plant life to survive. Conservation planting with trees and shrubs can also reduce energy bills by providing shade and wind protection to your home.

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

Remove turf and amend the soil with organic material to break up compacted clay. The ideal amount of organic soil amendment is 25-50% by volume. Choose plants that are 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 informal depending on your landscaping goals.



Maintenance

Like any new landscape, conservation landscapes will require some upkeep, but the maintenance is usually less 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 3-4 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. Over time, plants 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 little or no chemicals, and less water and gas, 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 the stormwater problem, but also 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, increasing stormwater capture and providing 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
Russian Olive (<i>Elaeagnus angustifolia</i>)	Fringe tree, Devilwood, Buckeyes, Serviceberries
Autumn olive (<i>Elaeagnus umbellata</i>)	Witch Hazel, Chokeberry, Wild Plums
Japanese honeysuckle	Trumpet honeysuckle, Cross Vine
Miscanthus grass	Switchgrass, Indian Grass, Purpletop, Pink Muhly grass
Privet	Blackhaw, Rusty Blackhaw, Indian Cherry, Native Dogwoods
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:

- [Native Plants for Wildlife Habitat and Conservation Landscaping - Chesapeake Natives/ USFWS](#)
- [Amending Clay Soils / NCSU](#)
- [Landscaping for Wildlife with Native Plants / NCSU + NC DFR](#)

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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 rainwater sponge, absorbing rainwater with a modified soil bed.

In addition to providing a place for rainwater to be used by the plants, they slow down and lessen the amount of water that runs to a creek. Rain gardens also filter water since stormwater runoff contains 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 amount of benefits when it comes to residential stormwater management



but what about... ?

(common myths associated with rain gardens, disputed, of course!)

myth:

fact:

Rain gardens are weed patches

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

Rain gardens will breed mosquitoes

⇒ 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 more maintenance than other gardens

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

Rain gardens don't work in clay soils

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

Rain gardens are comprised of water-loving plants

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

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've taken out the complicated part and made it as simple as possible for you to have your own beautiful rain garden in your own yard!



rain gardens of all shapes, sizes and locations:

front yards & backyards:



parks & offices:



streetscapes & parking lots:



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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, which is why replacing lawn with conservation planting 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? This 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 that 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 a rain garden.

The total roof area of a home is approximately the same square footage of your one story home, or the first floor of your multi-story home. (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 x width. Our example home has 1 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 which will drain down the front

of your house. Because you have a downspout on each end, divide that number by 2 to get the amount of area this will flow to one of the downspouts and runoff into the stream unless it is captured.

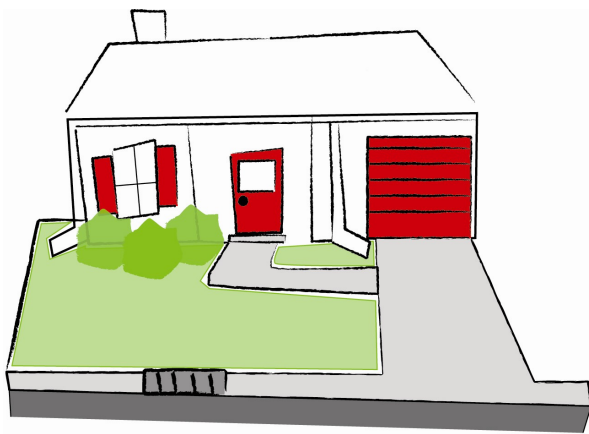
Step 2: Calculate the area of any concrete or other impermeable surface - driveway, walkways, outbuilding roofs, etc. that contributes to runoff leading to your rain garden. Measure length x width of each and add them all together.

Step 3: Add these two areas together. Area of the roof (Step 1) + area of all the other impervious surfaces (Step2). This 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. We use an average storm of 1 inch. 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. We construct rain gardens to be different depths such as 3, 4, or 6 inches deep. The deeper it is, the smaller the 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 sq ft in a 6 inch deep rain garden, divide the area from Step 3 by 6. That gives 100 square ft 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 2 directions. The problem area is in the front yard, where runoff quickly exits the property and flows into a storm drain.

- Total roof area = 1000 sq. feet
- Front half of roof = 500 sq. Feet
- Driveway + Walkway = 400 sq. feet
- Total Impervious area = 900 sq. feet.
- To create a 6" deep rain garden, divide the impervious area by 6.
- $900/6 = 150$ sq ft rain garden
- A 150 sq ft garden could be 10x15, or 5x30, or approximately 12x12, or about a 14 ft circle.

resources:

<http://www.bae.ncsu.edu/stormwater/>

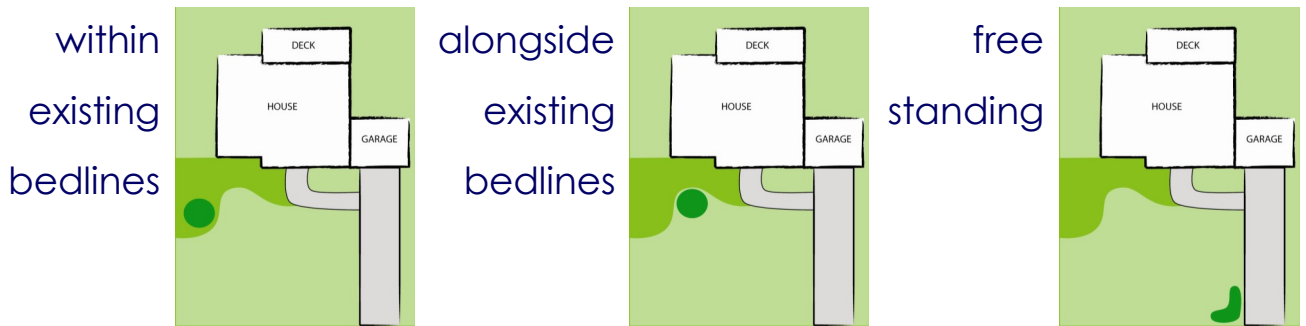
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location, location, location:

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' from a house foundation, 25' from a septic field, or 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 can and 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 does stand alone, relating the shape of the rain garden to your existing garden beds will help with a more cohesive look for your landscape.



your style, your rain garden:

Our landscapes are unique representations of us, and your rain garden can be too. Most gardens are generally informal or formal, and a rain garden can be either as well! A formal garden is one with straight, geometrically precise bedlines, bilateral symmetry planting, and sheared plants. An informal garden style is one with sweeping gentle, 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 1 inch storm so if you need to make it slightly bigger or smaller, that's 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 for. Identify these 2 spots 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; considerations that can make us all garden designers ! Let's take a look at these before we decide on exactly what to plant .

design considerations:

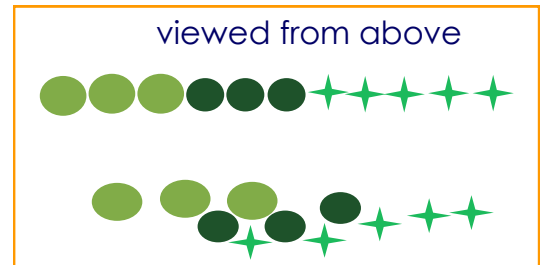
- Consider the adult size of the plant and space accordingly when planting.
- Plant in odd numbers, unless the individual plants will grow together to form a mass, then the mass of plants will be treated like one plant.
- Don't get too carried away with the odd numbers! Mix up the composition numbers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

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

Instead of:



try:

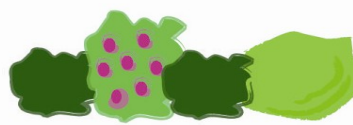


Limit the number of single specimens in your garden. Specimen plants should be used sparingly as to create interest in your garden.

instead of :



try:



A background of evergreens sets the stage for deciduous shrubs and perennials. This also insures that you will have 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:

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



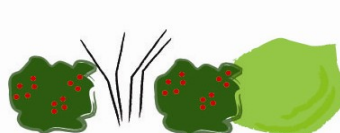
summer



fall

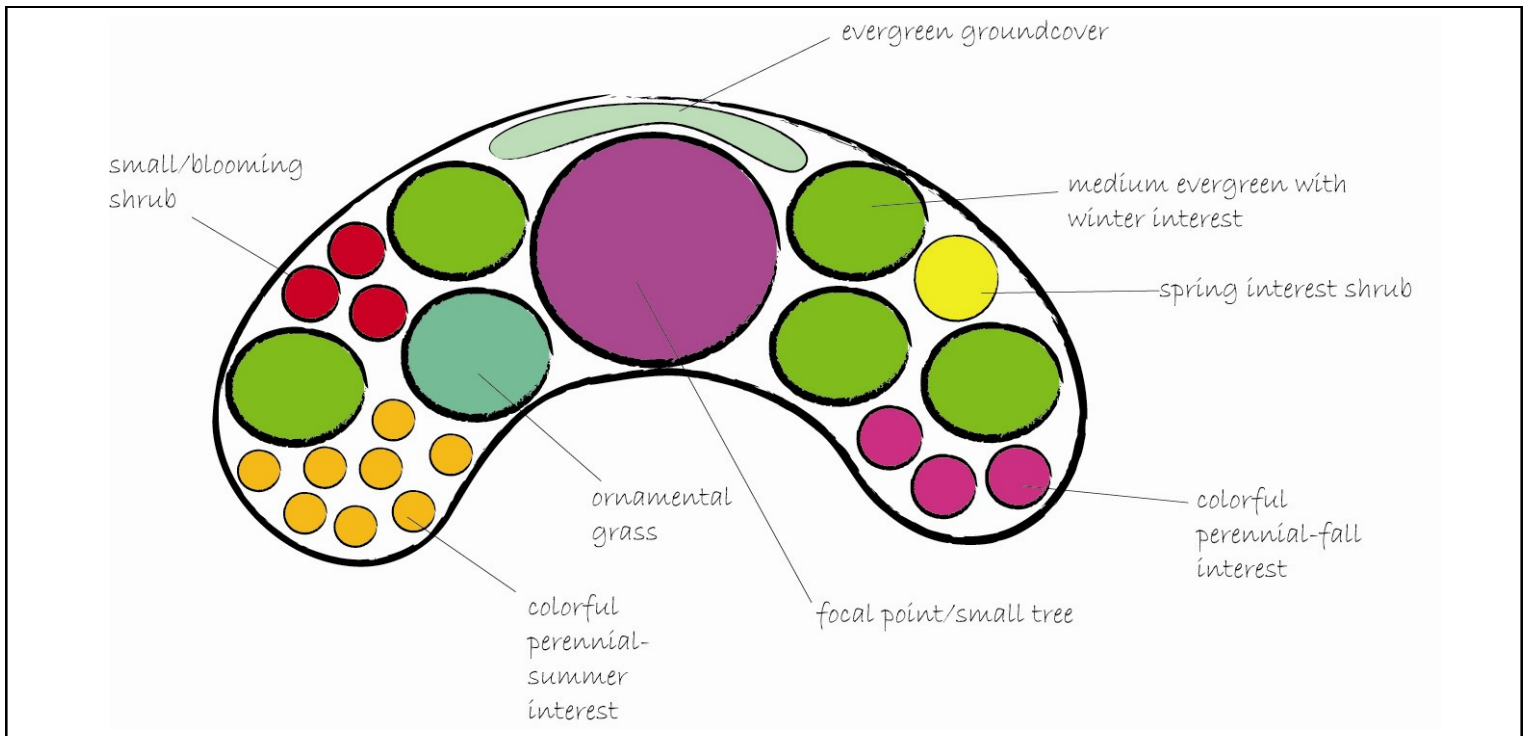


winter



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, making 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 - your rain garden can be any shape you want! Circles, squares, rectangles, ovals, triangles, long and straight, or curvy and narrow straight can all be beautiful garden shapes.



now you try it:

Remember: Your bed outline should relate to the surrounding landscape lines - your rain garden can be any shape you want!!

1. Start with the garden outline. Note location (sun, shade, part 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 1 inch grid. Each 1 inch represent 1 foot on the ground. (For a larger garden, you can make each 1 inch = 2 feet.)

resources:

Anne Spafford, Planting Design Class, NCSU

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



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first things first:

1. Call 811

811 identifies and marks underground utilities like cable, phone, electricity and gas. 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 before you plan to dig, but you can call as soon as you start thinking about a garden. Dial 811 or visit www.call811.com.

811 will come and mark your utility lines for free.



in the simplest terms, you will:

dig a hole s aerate the soil s amend the soil s plant plants s enjoy

tools you will need:

shovels, tarp, rake, rocks, plants, garden hose (or string , flags , spray paint)

next steps:

2. Infiltration test

Before purchasing any materials and further planning 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 inches deep and 12 inches wide
- Fill it with water.
- If it takes longer than 48 hours to drain, the site is not appropriate for a rain garden .
- If you hit the ground water table while you're digging the hole, the site is also not appropriate for a rain garden.



3. Outline your rain garden

Using a garden hose or some rope or string, layout the shape of your garden. The size you determined for your rain garden was for a rectangle, so lay out the rectangle first, and then

the steps:

move the length of hose around to the shape you want. The inside area will be close enough to the original rectangle you measure. Step back, take a look, and go back and move it some more until you are happy with the shape. A garden hose is the easiest tool for these quick moves, but you could use string or flags. You may want to let it sit there for a day or two so you can get the feel for how it will look in your landscape. Once you have the shape you want, you could mark the final bedlines with marking



paint or flags. Remember, the size was determined using an average 1 inch storm so if you need to make it slightly bigger or smaller, that's 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 for. Identify these 2 spots when laying out your rain garden. This is where you will incorporate some rocks.



4. Remove any turf

Use it 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 on which to place excavated soil. More than one tarp comes in handy.



resources:

- NCSU WECO resources page: www.ncsu.edu/WECO/
- NCSU Backyard Rain gardens factsheet
- NCSU Backyard rain gardens website
- NCSU provides residential rain garden instruction and certification. Find a list of certified professionals here: http://www.bae.ncsu.edu/stormwater/training/raingarden_professionals.html
- You can also ask your local garden store or nursery for ideas, especially on design and plant choice.

9. Set your inflow

The inflow point, where water enters your garden, can be under some extreme water flow conditions during rainfall events. Use rocks to help dissipate and disperse the energy flow of the water.

10. Set your outflow

Excess water that doesn't fit in the rain garden will flow over the lowest point of the berm. Decide where this will be and use rocks and plants to help stabilize this area.

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 gravel or fancier rocks. The rocks help slow down the water so it doesn't erode the edges of the rain garden. Rocks can also be used to channel water from your downspout to a rain garden.



11. Plant!

You can now plant your plants. You can also split up this project over a few days and plant next weekend. 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.

12. Mulch

Mulch does a few things. It lessens the extremes of weather temperature, keeping the soil cooler in summer and warmer in winter. It limits evaporation from the soil, holding moisture for plants. It helps stop weed seeds from sprouting. Triple shredded hardwood mulch is less likely to float during a rain event.

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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 holds some ponding water also.

6. Dig

When you sized your rain garden you determined how deep it would be. Remove that many inches of soil. For example if you sized your rain garden for 3 inches deep, remove 3 inches of soil. If you sized it for 6 inches, remove 6 inches of soil. Slope the sides of your rain garden and think about where your inflow and outflow will be as you dig. If your digging removes all the topsoil, you may want to dig an inch or two deeper and put back in the top in or two. You may use some of this soil to build a berm and work it in other area of the yard.

7. Amend the soil.

Add soil amendment to the garden hole. Soil amendments helps provide adequate drainage, reduce pollutant levels, and support plant growth. Turning the amendment into the soil aerates the soil. You want to end up with approximately 25% soil amendment, so if you are going to turn the soil 8 inches deep, add 2 inches of amendment. You may need to add back in some of the soil you removed from the tarp. Compost is often recommended as a soil amendment for residential rain gardens. Compost should be used cautiously when phosphorus removal is a main goal of the rain garden, such as those in the Jordan Lake watershed. Pine bark fines (pea-sized nuggets) is a good choice that breaks down more slowly than compost. It is available at garden stores. If only compost is available, ask for a mix with the lowest phosphorus content available.



8. Build a berm

If your rain garden is on a slope, use some of the excess soil to create a berm on the downhill end of the rain garden. This allows water to be retained during a storm. The overflow berm needs to be a few inches higher. It also needs to include the outflow area with rocks. The height of the berm will determine how much water is held in the garden.

a rain garden is just that - a garden!

It should be beautiful and have 4 seasons of interest. One problem commonly seen is that many gardens rely solely on perennials. This looks good in the summer, gets weedy looking in fall, and come winter, is often barren. A well-designed garden looks good in all seasons. To achieve this, incorporate a combination of woody plants (evergreen and deciduous) as well as perennials.

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 don't fret because they'll 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. And, 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 plant you will need. A sun garden receives at least 6 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.

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



the plants:

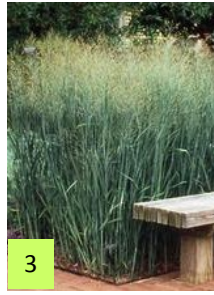
The plants on the following pages are just a sampling of rain garden plants. Please use the resources section to locate hundreds and thousands more plants, many of which have multiple varieties. A **deciduous** plant will lose its leaves in the winter, while an **evergreen** plant will hold its leaves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



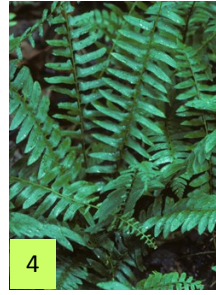
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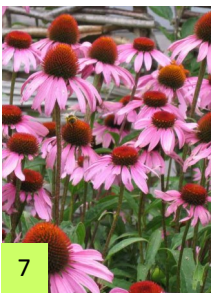
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perennials

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"x2 (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'



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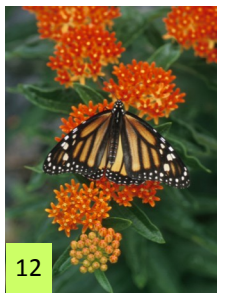
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resources:

USFWS: Native Plants for Wildlife Habitat and conservation Landscaping

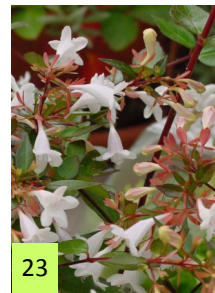
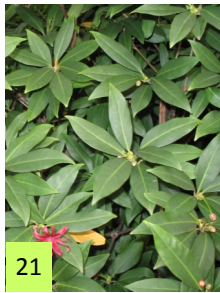
NCSU Cooperative Extension: Landscaping for Wildlife with Native Plants

NCSU Cooperative Extension rain garden plants - www.bae.ncsu.edu/topic/raingarden



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'
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 ♦ 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'



shrubs - evergreen

resources:

Use an online image search engine like Google or Bing to find pictures of many different species cultivars.

Find more information at University Extension sites such as [NCSU Plant Fact Sheets - <http://www.ces.ncsu.edu/depts/hort/consumer/factsheets>] or [Clemson Cooperative Extension Landscape Plants - www.clemson.edu/extension] and at [USDA Plant Profiles - <http://plants.usda.gov>]



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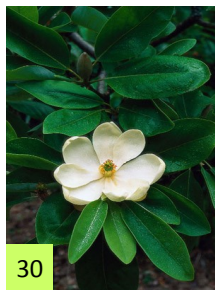


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groundcovers

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'
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'



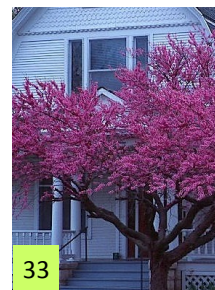
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trees

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.

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