# Rain Gardens: A Living Classroom

A K-12 Teacher's Manual

2017 Edition

North Carolina Coastal Federation

www.nccoast.org


*This manual is a product of the North Carolina Coastal Federation.*

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# Introduction

*Stormwater runoff* is the most prominent *pollutant* negatively affecting local waterways. As rain falls and makes its way over hard surfaces to a storm drain, it picks up pollutants such as bacteria, motor oil, pet waste, litter, and grass clippings. These pollutants from all over the community end up in the same water source due to natural *topography* and urban development. The area in which this occurs is called a *watershed*. Ultimately, pollutants from all watersheds end up in the ocean and other coastal habitats. These harmful contaminants cause: shellfish harvest closures, habitat degradation, fish kills, flooding, recreational swimming limitations, and more.

Storm drains are interconnected underground and deposit into creeks, streams, rivers, and other bodies of water which is a major source of runoff. Removing all storm drains would only increase flooding, and not be an effective means of reducing stormwater pollution. This means that alternative forms of development must be put into place to divert water and reduce volume from entering existing drains. This form of eco-friendly development is called *Low Impact Development*, or LID. A *rain garden* is a form of LID. LID also includes *permeable pavement, rain barrels, cisterns, and re-routed downspouts*.

The goal of a rain garden is to decrease the amount of rainfall that reaches a storm drain using native plants and ground structure. Rain gardens capture rainwater in a shallow depression, where it infiltrates into the soil and is transpired by *native plants*, recharging the *groundwater* system. Rain gardens are usually filled with mulch, are regularly maintained, and are naturally pollinated.

Not only do rain gardens reduce the amount of stormwater runoff that pollute our waterways, but they provide a habitat for a diverse range of plants and animals such as birds, butterflies, earthworms, and more. In addition, rain gardens are pleasing to the eye and add aesthetic value to an area.

There are so many benefits to installing a schoolyard rain garden, use this manual to best utilize your living classroom!

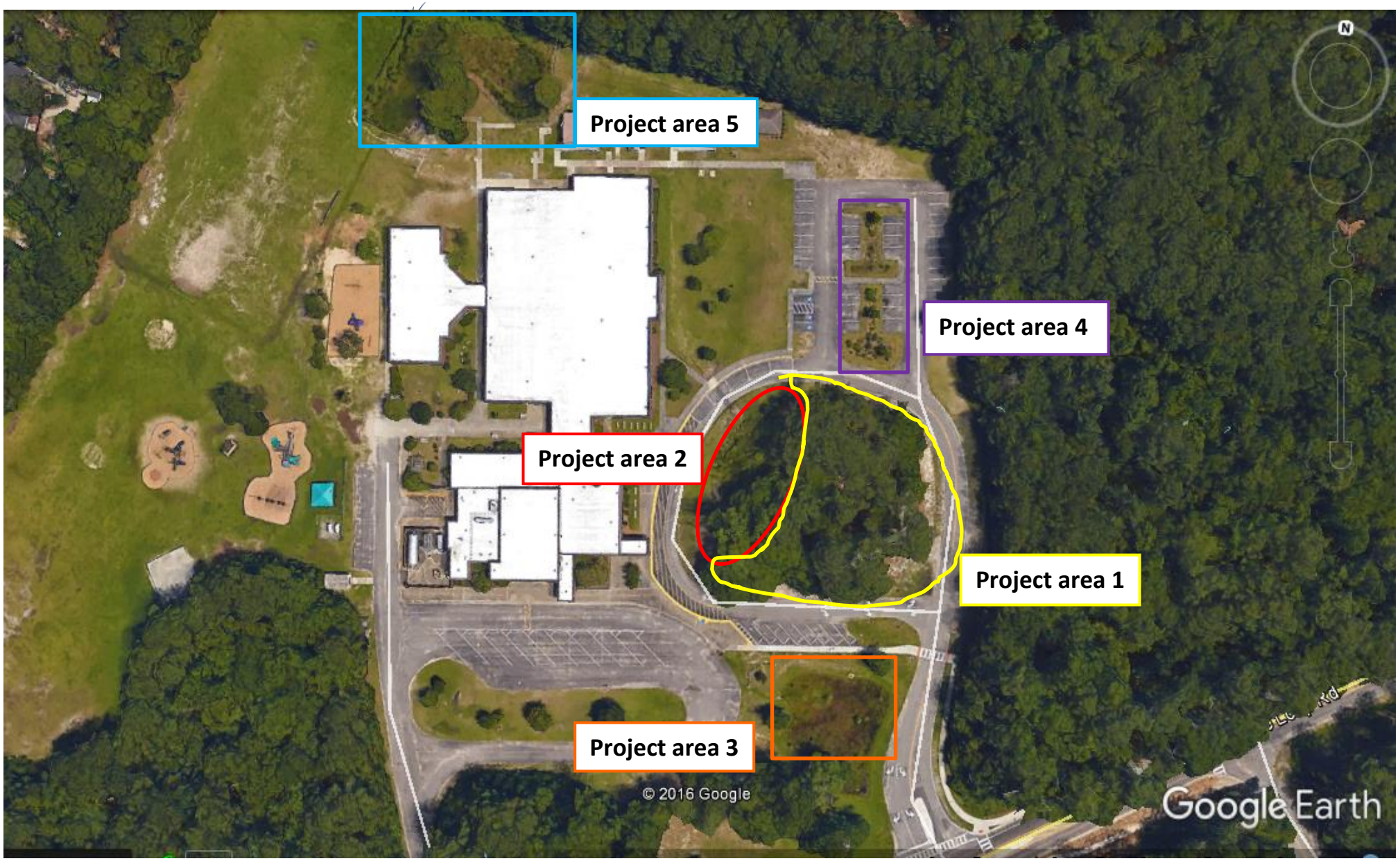
# Bradley Creek Elementary Stormwater Projects

Bradley Creek Elementary is a 19-acre site next to a *tributary* that drains to Hewlett's Creek. Hewlett's Creek is a very important ecosystem because it serves as a nursery for fish and is an area of high quality shellfish. It is a very productive estuary in terms of maintaining air quality, water quality, and performing many other ecosystem services. Unfortunately, most of the creek is closed to shellfish harvest and sometimes recreational swimming due to poor water quality. This pollution is mainly caused by stormwater runoff. Stormwater runoff is the movement of pollutants like oil, bacteria, litter, and more into local waterways from hard surfaces such as roads, sidewalks, and parking lots during rain events.

To reduce the volume of stormwater runoff entering Hewlett's Creek, the federation partnered with several organizations including New Hanover County Soil and Water Conservation District and the City of Wilmington to implement 5 stormwater *Best Management Practice (BMP)* projects. These BMPs used ground topography and native vegetation to trap and infiltrate stormwater before it enters the tributary that leads to Hewlett's Creek.

Project Area 1 is the area in front that is primarily a native vegetation area. Project Area 2 is a drought-tolerant wetland, also filled with native plants. Project Area 3 is a stormwater wetland. Project Area 4 is comprised of two adjacent rain gardens. And Project Area 5 is a large stormwater wetland in the back of the school. See the map on the next page for an aerial view of the project areas.

Altogether, these stormwater BMPs intercept 120,000 gallons of stormwater for every 1.5 inches of rain. Not only do they help reduce stormwater, but they also serve as "living classrooms" for the students and teachers at Bradley Creek where they can learn all about native plants, stormwater runoff, and more. The projects are equipped with educational signage, both in English and Spanish, to help increase understanding of the projects.

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# Alderman Elementary Stormwater Project

Alderman Elementary School is equipped with a bio-retention/rain garden area, a project made possible by the NC Coastal Federation, New Hanover County Public Schools, NC State University, and other partners. The large rain garden/bio-retention area is located in the front of the school and adjacent to the parking lot and entrance driveway. The rain garden/bio-retention area treats stormwater runoff from a portion of the school roof, the pedestrian entrance area and walkways, the school entrance driveway, and the school parking lot.

This 2,500 square foot retention area is comprised of native plants in a shallow depression, a design commonly used to infiltrate ample amounts of stormwater runoff. The native plants use the water to grow and can clean the stormwater before it is re-introduced into the groundwater system. During construction, community volunteers and 3rd graders at Alderman were engaged to install 400 plants and several yards of mulch and sod in the garden, and participate in environmental educational activities.

The bio-retention area was designed to treat 1.5 inches of rainwater in the 15,850 $ft^2$ project area, instead of allowing polluted stormwater to enter Hewlett's Creek. Polluted stormwater in Hewlett's creek degrades coastal habitats, prohibits shellfish harvesting, limits recreational swimming, and has overall negative impacts on water and air quality.

The rain garden is also used as a living classroom, where elementary school students can learn hands-on about stormwater runoff and rain gardens.

# Maintaining your schoolyard rain garden

Rain gardens need periodic maintenance. The North Carolina Coastal Federation organizes volunteer days at our current schoolyard rain garden sites where we recruit volunteers to help with weeding, planting, mulching, edging, and more. These are open to the community and service groups, but we invite students and teachers to join as well.

The federation is able to assist in organizing large-scale volunteer events, but there are plenty of ways you and your students can improve your rain garden on a more consistent basis. Daily, weekly, or monthly maintenance of the schoolyard rain garden is a great way for students to feel ownership of a project and to enhance environmental stewardship behaviors in the students for years to come. You and your students could:

- Water plants after a period of little rainfall (use recycled water if you have a rain barrel on site!).
- Remove ground weeds and move them out of garden area or use them for composting.
- Remove trash or debris.
- Trim dead portions of plants.
- Replace mulch as needed.
- Plant native plants (http://www.cfpua.org/DocumentCenter/Home/View/269).
- Inspect rain garden area for problems with sedimentation or erosion.
- Inspect the area for signs of harmful invasive species such as wisteria and kudzu (http://www.ncwildflower.org/plant_gallerie/invasives_list).

With any outdoor activity, please be mindful of the possible safety issues. Please be aware if any students are allergic to beestings, point out any poison ivy, and be on a watchful eye for other types of wildlife or sharp objects.

The NC Coastal Federation is able to lend garden tools (gloves, shovels, spades, buckets, etc.) and provide mulch for rain garden maintenance. Please coordinate with federation staff to receive and return the appropriate tools and resources. Happy gardening!

# Rain Garden Journal

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2

**English:** Range of writing, text types and purposes, research to build and present knowledge, presentation of knowledge and ideas, conventions of standard English

**Objective:** Students will gain knowledge and appreciation for their schoolyard rain garden through observation and the use of writing and/or drawing.

**Grade level:** K-5

**Time needed:** Multiple 15-30 minute sessions

**Materials:** Journal or notebook**,** Pencil or pen**,** colored pencils, markers

**Procedure:**

This is a long-term assignment designed for students with a schoolyard rain garden. Bring the students to the garden at consistent intervals, such as once every two weeks or once a month, to track the status of the garden and how it changes throughout the year. This journal could be a combination of the ideas below:

- Ask students to observe the sight, smell, sounds, and feeling of the rain garden. Write these words in the journal.
- Ask students to write a poem about the rain garden.
- Ask students to draw a picture of the rain garden as a whole, or to pick one specific plant to draw.
- Ask students to draw what a rain garden would look like in their own yard.

**Wrap up:**

- Challenge students to compare and contrast what the rain garden looked like during different times of the year. What do they notice?
- Will students be encouraged to start a garden in their own yard?

# Rain Garden Similes

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2

**English:** Text types and purposes, research to build and present knowledge, presentation of knowledge and ideas, conventions of standard English

**Objective:** Students will better understand the functions and benefits of rain gardens by making comparisons and performing critical thinking.

**Grade level:** K-5

**Time needed:** 15 minutes

**Materials:** Simile cards, objects, or pictures

**Procedure:**

- Ask students what a simile is, and give an example. For example, the sky is as blue as the ocean.
- Tell students that many items and places can be compared to rain gardens in this way.
- Pass out one simile card to each student. Explain to students that there is no one answer to these simile cards, so encourage them to think as outside the box as they wish.
    - Each card should say "a rain garden is like a BLANK because…." Consider adding pictures for younger students.
- Allow students to work out their response with a friend or seek help.
- After a few minutes, ask students if they'd like to share.

**Simile examples:**

- A rain garden is like **cat litter** because it traps pollutants.
- A rain garden is like a **sink** because water from different impermeable surfaces run into it, it holds water, and it drains water.
- A rain garden is like a **zoo** because a variety of plants and animals live there, or because people will visit it.
- A rain garden is like a **coffee filter** because it filters pollutants and allows clean water back into the ground.
- A rain garden is like a **pasta strainer** because it filters pollutants and allows clean water back into the ground, or because the plant's roots resemble noodles.
- A rain garden is like a **hotel** because pollinators come to pollinate flowers at certain times of the year, or because certain animals feed at certain times and days.

- A rain garden is like a **refrigerator** because it provides a food source for various small animals, or because plants receive nutrients from the soil.
- A rain garden is like a **home** because a variety of plants occupy the same area for the entire year, or some animals use it for a habitat such as earthworms.
- A rain garden is like a **cradle** it gives way to juvenile plants at the beginning of the season and allows for an ideal place to grow.
- A rain garden is like **soap** because it makes the water clean before it enters back into the ground.
- A rain garden is like a **sponge** because it soaks up pollutants and water.
- A rain garden is like **funnel** because it captures runoff from various places and guides water through the infiltration process reducing the amount of runoff that ends up in a waterway.
- A rain garden is like a **painting** because it is pretty to look at, and is very colorful.
- A rain garden is like a **mouse trap** because it traps stormwater runoff.

**Wrap up:**

- Challenge students to make up their own simile.
- What are some parts of the rain garden that can be compared to one another, instead of the rain garden as a whole?

# Rain Garden Year

*Adapted from the University of Wisconsin-Madison Arboretum*

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2,

**English:** Text types and purposes, research to build and present knowledge, presentation of knowledge and ideas, conventions of standard English

**Theatre Arts:** K.C1.1, K.C.2.2, K.A.1, 1.C.1.1, 1.C.2.2, 2.C.1.1, 2.A.1.2, , 3.C.2.2, 4.C.2.2,

**Objective:** Students use a model to explain how rain gardens grow in the natural world by taking part in a play. Through this, they will increase understanding of plant adaptations and the purpose of rain gardens.

**Grade level:** K-5

**Time needed:** 25 minutes

**Materials:** Laminated rain garden plant cards, narration script with rain garden year schedule, musical instruments (optional)

**Procedure:**

- Take students outside to tour the rain garden.
- Ask students to share any observations based on their five senses.
- Discuss the benefits of a rain garden – infiltrate stormwater, native plants, create habitat, add aesthetic value
- Pass out rain garden plant cards.
- Begin narration and allow students to act like they are growing plants.

(*All students should be in a group and crouched down. They are the root of their plant.) "*It is a cold winter season. The days are cold and short. Nights are long. To most humans, the rain garden looks lifeless. All above-ground portions of the plants are brown and brittle. But underneath, the roots are quite alive. "

"You are our rain garden. You are living roots of your plants with a blanket of snow over your heads. The covering of snow keeps the soil and roots protected. At the same time, the dry plant parts above ground provide winter cover to small animals."

*(students start to sit up, as plant blooms they hold card up)* "As the days start to get warmer and longer, the snow melts, and the soil warms. Spring rains begin, and plants start to grow – leaves start to emerge from the ground. The growing plants in the rain garden absorb the snowmelt and spring rains, filtering out pollutants along the way."

"Now it is (insert month) and the (insert blooming plants) begin to bloom while the (insert names of plants) stop blooming and begin to set seed.

"Now it is May…"

| Month | Blooms | Stop Blooming, Set Seed |
|---|---|---|
| April | Wax Myrtle, Spicebush | |
| May | Washington Hawthorn, Blue Flag Iris, Texas Star | Wax Myrtle, Spicebush |
| June | Mouse Ear Coreopsis, Sweet Bay Magnolia, False Indigo | Washington Hawthorn, Blue Flag Iris, Texas Star |
| July | Swamp Milkweed, Garden Phlox, Butterfly-Weed, Cardinal Flower | Mouse Ear Coreopsis, Sweet Bay Magnolia, False Indigo |
| August | Golden Rod, Marsh Mallow, Bultonia | Swamp Milkweed, Garden Phlox, Butterfly-Weed, Cardinal Flower |
| September | Joe-Pye Weed, Green Headed Coneflower, Verbena | Golden Rod, Marsh Mallow, Bultonia |
| October | Swamp Sunflower | Joe-Pye Weed, Green Headed Coneflower, Verbena |
| November | | Swamp Sunflower |

"Now the temperatures are getting colder and the days shorter and the nights longer. The aboveground portion of the plants dies and only the roots are alive, (*Students crouch back down).* The winter is back and our schools rain garden looks lifeless. But it is not lifeless; it is alive and waiting—waiting for another year."

**Wrap Up:**

- Have students draw a picture of a place (home, restaurant, business etc.) that they think should have a rain garden and label the design features.
- Ask students to provide examples of a time they witnessed stormwater runoff.
- Have students draw their assigned plant and talk about the benefits it has.
- How could the students act out other parts of the rain garden?

# Rain Garden Art

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2

**English:** Presentation of knowledge and ideas

**Visual Arts:** K.V.1, K.V.2, K.V.3, 1.V.1, 1.V.2, 1.V.3, 2.V.1, 2.V.2, 2.V.3, 3.V.1, 3.V.2, 3.V.3, 4.V.1, 4.V.2, 4.V.3, 5.V.1, 5.V.2, 5.V.3

**Objective:** Students will gain a higher appreciation for rain gardens by utilizing the natural beauty of the garden to create an art piece, instilling a sense of stewardship.

**Grade level:** K-5

**Time needed:** 1 hour and 30 minutes

**Materials:** Paper bags, list of ecological items (pine cone, bird feather, leaf etc.), clear sticky contact paper, paper plates or poster board, art materials (crayons, markers, watercolor etc.)

**Procedure:**

**Classroom Preparation**

1. Decide if you will make individual collages or a group collage.
2. Individual collages: Wrap paper plates in sticky contact paper to be used as a personal canvas.
3. Group project: Wrap a large poster board in sticky contact paper to be used as a group canvas.
4. Have all art materials laid out and ready for students to return from outside.

**Outside**

1. Lead students out to the rain garden.
2. Define rain garden for students.
3. Inform students how a rain garden functions.
4. Describe why their specific rain garden is unique.
    a. Where does the stormwater runoff originate for their specific rain garden?
    b. What stream or body of water is benefiting from the rain garden?
5. Pass out list of ecological items. (Pair students of different reading abilities or use pictures.)
6. Pass out paper bags for students to use as a collection device.
7. Remind students that a rain garden contains many different plants and animals, but as stewards it is there job to protect the rain garden. Inform students not to collect living animals, or to pick living plants. Express to them that the items they collect should be unattached and lying on the ground.
8. Set a specific time limit that students have to collect items.
9. After the set time limit, have all the students gather up and return to the classroom.

10. Students can then apply there ecological items to the sticky contact paper and create a beautiful rain garden collage.

**Wrap Up:**

- Ask students to present their artwork to the class. Why did they pick the elements they did?

## Rain Garden Engineers

**Common Core Standards:**

**Science:** 3.L.2. 4.L.1. 5.L.2

**Objective:** Students will gain a better understanding of the resources needed to build a rain garden that will work efficiently and effectively by performing critical thinking.

**Grade level:** 3-5

**Time needed:** 15 minutes

**Materials:** Rain garden engineer cards (multiple sets for multiple groups)

**Procedure:**

- Explain to students the concept of stormwater runoff and how rain gardens help to reduce stormwater runoff.
- Break students up into small groups of 3-4 students.
- Tell students that they are all teams of engineers that have been contracted to build a new rain garden for their school. They must make the rain garden work well enough to infiltrate water, but also save the most money.
- Lay rain garden engineering cards out on the table or on the floor in their appropriate pairs listed below. The bolded option is the one of the pair that should be chosen for the rain garden. Allow students to pick a card from each pair to construct "their garden"
    - **Bee** (pollinator)/eggplant flea beetle (pest)
    - **Soft surface/**hard surface
    - **Rake**/broom
    - **Shallow depression**/30-foot hole
    - **Recruit volunteers**/hire employees
    - Hydrilla (non-native invasive)/**seaside goldenrod** (native)
    - **Black-eyed susan** (native)/tree of heaven (non-native invasive)
    - Away from all impervious surfaces, far from storm drains/**near impervious surfaces/close to storm drains**
    - **Grassy area**/mountaintop
    - Squash bug (pest) /**ruby-throated hummingbird** (pollinator)
    - Gravel/**bagged mulch or soil**
    - Alligatorweed (non-native invasive)/**dwarf yaupon holly** (native)
    - Toy shovel/**shovel**
- Instructors will assist the teams as they "build" their rain garden by helping to identify species/technical terms.

**Wrap up:**

- Ask students why they built their garden the way they did.
- Does anybody want to be an engineer when they grow up? Why?

## Stormwater Hopscotch

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2

**Objective:** Students will understand how rain gardens and other stormwater management Best Management Practices (BMPs) prevent pollution from entering coastal waters by simulating a rain drop making its way to an estuary.

**Grade level**: K-5

**Time needed:** 30 minutes

**Materials:** Hopscotch squares, tape, clear plastic container labeled "estuary", toy crab or other estuarine animal, jug of fresh water, pollution (grass clippings, food coloring, cut up pieces of candy wrapper, bottle cap, tootsie rolls/chocolate sprinkles as pet waste).

**Procedure:**

The hopscotch course acts as a linear map of the path a raindrop might take after falling from the sky. Along the way the raindrop may gather pollution or pass through a BMP.

Have students imagine themselves as a rain drop that just fell from the sky. They are about to land on the roof of a house and go on a journey.

1. Hopscotch refresher video: https://www.youtube.com/watch?v=VJy-gr1jhvs)
2. Lay out the hopscotch squares to make a hopscotch course.
3. Tape them to the ground to prevent slippage.
4. After the number 9, draw a path with blue chalk to symbolize the inside of a storm drain.
5. At the end of the storm drain illustration, place the clear container.
6. Add the toy crab and fill partially with clean water. This container symbolizes an "estuary".
7. Next to the "estuary", neatly organize all the pollutants into small piles.
8. Place a cup of clean water next to the pollutants.
9. Explain to players the theme of the hopscotch course.
10. Have players play hopscotch using the traditional method by throwing a marker such as a shell on the course. The marker is traditionally picked up on the return, however in this variation, there is no return journey. The marker is picked up as the participant hopscotches through in one direction. The square that the marker lands on designates what pollution, if any, they as a raindrop have picked up as

runoff on their way to the "estuary". If they pick up their marker from a polluted square, they are expected to pick the matching pollution and place it into the "estuary". If they land their marker on a square that is a BMP, they pour a small amount of clean water from the cup into the "estuary".

11. Squares
    - 1. Front lawn – Clean water
    - 2. Downspout – Clean water
    - 3. Rain Barrel –Clean water
    - 4. Lawn Care –Grass clippings
    - 5. Rain Garden –Clean water
    - 6. Litter – Cut up candy wrapper pieces, bottle caps, plastic etc.
    - 7. Pet Waste – Tootsie Roll
    - 8. Storm Drain – Drop of food coloring
    - 9. No Dumping – Clean Water
12. All traditional rules of hopscotch apply. The first person to complete the course wins.
13. Have participants gather around the "estuary" to discuss their observations.

**Variation for younger participants (K – 3)**

Print minimized images (the size of playing cards) of the polluted hopscotch squares. Print enough to provide a raffle of sorts. Have the players line up at the start of the course. In place of throwing a marker, have the player draw from a box one of the minimized cards. Have them match their card to the hopscotch square while simultaneously signaling to an additional facilitator which card they drew. The additional facilitator can then place the according pollution on the appropriate square before the player begins. The player then begins to hopscotch through the course. When they get to the polluted square they pick up the pollutant that the 2nd facilitator placed on the square. They then hopscotch through the rest of the course and continue down the "storm drain". They then empty out into the "estuary" by placing their pollutant into the clear container with the toy crab. BMP's are discussed, but there is no card for bmp's and cups of water are not used in this variation.

**Wrap Up**

- Have participants share their insights and observations of the "estuary."
- Invite participants to explain the role of watersheds and estuaries.
- What issues arise when water quality is poor due to polluted stormwater runoff?
- Challenge participants to list ways in which stormwater runoff can be mitigated.
- Ask participants to give examples of when they have witnessed runoff. Do they think it was polluted? Where did it go?

# Rain Garden Dodgeball

**Common Core Standards:**

**Science:** K.E.1, 1.E.2, 1.L.1, 2.L.2, 3.L.2, 4.L.1, 5.L.2

**Objective:** Students will understand the broad concept that rain gardens use native plants to prevent pollutants from entering local waterways by playing an active, role-playing game.

**Grade level:** K-5

**Time needed:** 25 minutes

**Materials:** Tennis balls (the more the better), Open/flat space – indoor or outdoor, cones or markers to lay out playing field, Necklace signs for each group (optional), marine stuffed animals (optional)

**Procedure:**

- Explain to students the function of native plants in a rain garden as water purifiers during a rain event. Rain gardens pool up stormwater to allow it to infiltrate the ground, as the root systems of native plants clean the water to recharge the groundwater system.
- Split students up into three groups:
  - **Group One: Rain drops**
  - **Group Two: Native plants**
  - **Group Three: Estuary**
- Set students up the following way within the playing field. The arrow represents the direction they are facing.

| Group one (with tennis balls) → | Group two (with plant necklaces) ← | Group three (with marine animal toys) ← |
|---|---|---|

- Give group one all the tennis balls. Tell the students that each tennis ball represents one unit of pollution from stormwater runoff. They will be **rolling** the tennis balls towards group three, but must pass group two.

- Tell group two to all kneel down facing group one. They are not allowed to move their feet or legs, they can only move their arms and hips. Their job is to swat away the tennis balls rolled at them by group one.
- Set up group three behind group two. Their job is to collect all the tennis balls that make it through group two.
- Allow the students to play the game. The goal is to have the least amount of pollution reaching the Estuary
- Allow students to play in each group.

**Wrap-Up:**

- Try different variations of the game where you remove native plants or add rain drops and they are in uneven numbers. What happens?
- Ask students to explain what they noticed from this game.
- Why is it important to build rain gardens? What are some other reasons other than what was described in this activity?
- Why are native plants so important?

# Rain Garden Percolation Test

**Common Core Standards:**

**Science:** 4.L.1, 5.L.2

**Objective:** Students will understand how rain gardens infiltrate water by performing scientific experimentation and analyzing percolation.

**Grade level:** 4-5

**Time needed:** 30 minutes

**Materials:**

- Coffee Can (aluminum)
- Water
- Graduated cylinder (500 mL)
- Data Sheet
- Clipboard
- Pencil
- Stopwatch/Phone
- Calculator/Phone

1. Read through the experiment instructions, then on data sheet make a hypothesis about the outcome of the experiment.
2. Clear loose leaf-litter and mulch to expose soil surface. Try not to disturb the soil surface.
3. Insert one end of the coffee can approximately 5 cm into the soil and then remove the can.
4. Pour 500 ml of water into soil divot and begin the stopwatch.
5. Stop the stopwatch when the standing water is no longer visible and only the soil surface is visible. Record the time on data sheet. This is the **dry percolation time.**
6. Repeat step 4-5 now that the ground is saturated. This is the **wet percolation time.**
7. Calculate the **percolation rate** and record on data sheet: Rate = *(.5 liters/dry percolation time)*
8. Collect a small handful of soil and rub it between fingers and record **soil texture**.
    a. Gritty = sand
    b. Slippery = silt
    c. Sticky = clay
    d. Combination sandy-silt
9. Examine and record amount of **leaf litter**. Include any qualitative observations.
10. Collect a small amount of soil in hand from an area within one can length from the measurement (an area not affected by water from the activity) and record **soil moisture** on data sheet.

. Wet = if water squeezed out

a. Damp = if soil holds its shape

b. Dry = if sample will not hold its shape when squeezed

11. Note other observations such as: smell, roots, insects, shells or trash found in your area.

## Data Sheet

I hypothesize that the wet percolation rate will be (choose one: less/more) than the dry percolation rate because… _____.

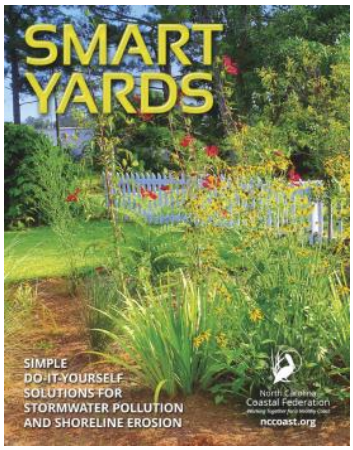
| Observation | Results |
|---|---|
| *Dry percolation time (seconds)* | |
| *Wet percolation time (seconds)* | |
| *Percolation rate (liters/second)* | |
| *Soil texture* | |
| *Leaf litter* | |
| *Soil moisture* | |

Other observations:

**Wrap up:**

- Repeat this experiment under different conditions – after a rain storm or after a period of little rain. How did your results change?
- Why do we care about percolation rate when it comes to the purpose of rain gardens?

## Extensions




If you want to learn more about installing a new rain garden, a rain barrel, or another stormwater BMP at your school or home, please view our **Smart Yards magazine**. Smart Yards is available in paper copy at the NC Coastal Federation office, 309 W. Salisbury Street in Wrightsville Beach, or online at http://www.nccoast.org/wp-content/uploads/2017/03/SmartYards.pdf.

To extend your students' knowledge of stormwater runoff, we encourage you to plan a field trip to the NC Coastal Federation office for a **Walk the Loop for Clean Water tour**. This tour highlights stormwater BMPs on a portion of the beautiful Wrightsville Beach walking loop. It includes rain gardens, swales, cisterns, permeable pavement, and more. This will give students a "big picture" idea of how their schoolyard rain garden contributes to alleviating stormwater runoff pollution. More information can be found at www.walktheloop.org.

The **N.C Cooperative Extension** offers rain garden workshop days, where you can learn how to build and design a rain garden, and learn about native plants. More details can be found at https://currituck.ces.ncsu.edu/2015/07/rain-gardens/.

*For any questions, concerns, or to plan an education program, please contact Ted Wilgis at tedw@nccoast.org or at (910) 509-2838 Ext. 202.*

*The North Carolina Coastal Federation is located at the Fred and Alice Stanback Coastal Education Center, 309 W. Salisbury Street in Wrightsville Beach next to the history museum and visitor's center. Office hours are Monday-Friday from 8:30 a.m. - 5:00 p.m.*

# Glossary of Terms

***Best Management Practice (BMP)*** – a practice, or combination of practices, that is determined to be an effective and practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

***Cistern*** – a reservoir, tank, or container for storing or holding water or other liquid.

***Groundwater*** – all water which is below the surface of the ground in the saturated zone and which is in direct contact with the ground or subsoil.

***Low Impact Development (LID)*** – systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.

***Native plant*** – one that occurs naturally in a particular region, ecosystem, or habitat without direct or indirect human intervention.

***Permeable pavement*** – specific type of pavement with a high porosity that allows rainwater to pass through it into the ground below.

***Pollutant*** – any substance, as certain chemicals or waste products, that renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose; something that pollutes.

***Rain barrel*** – A barrel used to catch rainwater running off roofs, usually underneath a downspout.

***Rain garden*** – a shallow depression that is planted with deep-rooted native plants and grasses.

***Re-routed downspout*** – Downspout from roof that has shifted direction due to the installation of an elbow or other device to divert water to another area.

***Stormwater runoff*** – generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm our rivers, streams, lakes, and coastal waters.

***Tributary*** – a stream that flows into a larger stream or river or into a lake.

***Topography*** **-** the arrangement of the natural and artificial physical features of an area.

***Watershed*** – an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.

# Sources/Helpful links

General information:

https://www.epa.gov/npdes/npdes-stormwater-program

https://water.usgs.gov/edu/watershed.html

https://www.epa.gov/nps/urban-runoff-low-impact-development

https://www.go-gba.org/resources/green-building-methods/permeable-pavements/

http://www.raingardennetwork.com/

http://snr.unl.edu/data/water/groundwater/realtime/satuate.aspx

http://ncforestservice.gov/water_quality/what_are_bmps.htm

http://www.raingardennetwork.com/

Rain garden maintenance:

http://www.water.rutgers.edu/Projects/RGRebate/RGMaintenance.pdf

http://www.usna.usda.gov/Gardens/faqs/nativefaq2.html

http://www.cfpua.org/DocumentCenter/Home/View/269

https://www.bae.ncsu.edu/extension/ext-publications/water/protecting/RainGardenManual2014.pdf

Other educational activities:

http://www.irwp.org/education-and-outreach/rain-gardens-for-educators/

https://www.kidsgardening.org/lesson-plans-rain-gardens/