

Stormwater and You

**What
is a
Watershed?**

**Excess
Runoff**

**All
Dried Up**

**Harvesting
Rainwater**



Xeriscaping

**Compost
& Grass
Cycling**

**Are You
Water
Wise?**

**Conservation
Station**



What is a Watershed?



A watershed is the area of land that drains to a common body of water. Water from rain and snow falls on the land surface and then drains or seeps into a wetland, marsh, stream, river, lake or into the groundwater. Water always runs to the lowest point in a watershed. Some water soaks into the ground, where it becomes groundwater. Other water flows across fields, forests, streets, parking lots and lawns before it flows into streams, rivers, lakes and estuaries. This water is called stormwater runoff. Watersheds are habitats for plants and animals and are places for people to live, work and play. We depend on water within our watersheds to supply drinking water and water for the food we eat.

or estuary. Water that falls on the other side travels to another ocean or estuary. The New, Watauga, French Broad, Little Tennessee and Hiwassee river basins flow to the Mississippi River and eventually to the Gulf of Mexico. All other river basins in North Carolina flow to the Atlantic Ocean.

Everyone lives in a watershed. Which river basin do you live in? Where does the water flowing in your creeks and rivers end up? can capture water when there is a storm. The water soaks into the ground instead of flooding the land. From there it can slowly release through streams, rivers and wetlands. When stormwater flows across the land, it picks up eroded soil, leaves, oil, fertilizers, pesticides and anything else in its way. Sediment and chemicals can pollute the river, stream or lake where the water ends up. The health of a river basin is affected by the people living within its borders and the choices they make every day.

Everyone lives in a watershed. Which river basin do you live in? Where does the water flowing in your creeks and rivers end up?



North Carolina's River Basins

North Carolina has 17 river basins. Each is made up of smaller watersheds. Rivers from these 17 river basins flow into either the Gulf of Mexico or Atlantic Ocean. The Eastern Continental Divide separates the watersheds of these two huge water bodies. A continental divide is a line of mountains or hills that form a border between two watersheds. Water that falls on one side of the line eventually travels to one ocean

A Healthy River Basin

A healthy river basin can help people in many ways. When a river basin functions properly, it

People can take action to reduce the pollution that ends up in stormwater. Building ponds and wetlands helps reduce the amount of stormwater that runs off, which can reduce flooding. Other actions, like using rain barrels and preventing erosion, can conserve water that may be needed in a drought.

Source: Conservation Technology Information Center
<http://www2.ctic.purdue.edu/kyw/>

Teacher's Note: Topographic maps of your area can be ordered from the N.C. Geological Survey by calling 919.733.2423 or visiting the Geological Survey Shop online at <http://www.store.yahoo.net/nc-maps>.

Activity: Map Your Watershed



Look at a city or county map and locate the stream nearest your school. Next, use a topographic map and find the stream on that map. Find and mark your school on the topographic map. Look for other creeks that feed into your stream. Where do they start? Using the contour lines (lines that show elevation) on your topographic map, find the highest hills around your stream. Draw a line connecting the tops of the hills around your stream. Draw blue arrows on your map that will show how water runs downhill from the tops of the hills toward your stream. The land area that drains into your stream is your watershed. Where does your stream end? Your stream should drain into a larger body of water – a pond, river, lake or the ocean.

Excess Runoff

So, we learned that a healthy watershed soaks up and stores water when it rains. This helps prevent floods. Hard, or impervious, surfaces cause stormwater to flow quickly over the ground, directly into creeks, streams and rivers. Undeveloped land, like forests, fields and wetlands, allows water to soak into the ground.

Wetlands are especially important parts of the watershed. A wetland is just what the word says – wet land. An area of land that is covered with water part or all of the year can be considered a wetland. When it rains, the soil and mud of a wetland act like a sponge and store the extra water. If wetlands are developed into shopping malls, office buildings or even houses, the soil is no longer able to soak up water.

The more **impervious surfaces** in an area – such as parking lots, roads, rooftops, carports, driveways and sidewalks – the more water will run off instead

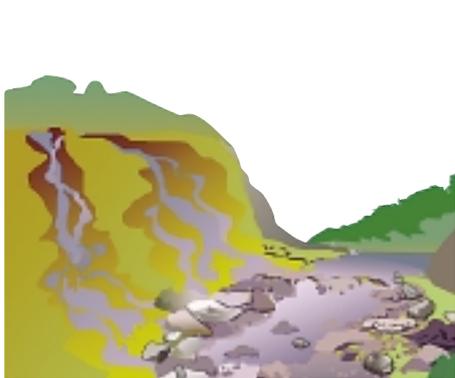
of sinking into the ground. In fact, in developed areas with lots of impervious surface, excess runoff can overload storm sewers and drainage ditches quickly. A local flood is the result. This is why urban areas can flood even though the same amount of rainfall in a rural area will not cause a flood.



Too much stormwater flowing into creeks and rivers is definitely a problem. However, the quality of the water is important, too. Stormwater runoff can pick up pollution as it flows over the ground. Pollution may be something we can easily see like litter or leaves, or something that's harder to see, like motor oil left on the driveway from a leaky car or bacteria in pet waste left on the ground. Bare soil can be washed away by quickly moving stormwater runoff into creeks. This process is called erosion. Eroded soil is the No. 1 pollutant in North Carolina's water.

Here are some things people can do to keep stormwater from getting polluted:

- Wash the car over gravel or grass so the dirty water soaks into the ground rather than running into the storm drain.
- Don't litter and encourage others not to litter.
- Compost leaves so they don't end up in stormwater runoff and clog storm drains.
- Plant flowers or grass on bare ground so the soil doesn't wash away when it rains. Plants help to anchor soil in place, reducing erosion.



In the News

In this supplement you have learned about environmental problems related to stormwater runoff. What recent events or activities in our area do you think may cause problems to creeks, rivers, lakes and streams? What do you think can be done in the future to lessen the severity of damage from events or activities like these?

Activity: Be a Rainwater Detective!



The next time it rains, put on your rain gear and go out and explore stormwater in action with an adult. What happens to the rain that falls on or around your school? Where does the water that falls on the roof go? What about water on the parking lot? Can you see water flowing in the natural areas around your school? Does the water gather in any one place, or does it keep moving? Where do you think the moving water is going? Do you see any erosion taking place? Do you see any places that the stormwater can pick up pollution? Think about ways you or your classmates can reduce the quantity of water that flows off your school campus. Also, see if you can come up with ways to reduce any sources of pollution you see.

All Dried Up

We know that too much water can be a problem, but sometimes our communities can be in trouble because we have too little water to go around. When we don't have enough water to meet the demand, scientists call that a drought. Most of us think of a drought as "no rainfall," but it's not that simple. Drought is when there is less rainfall than was expected over an extended period of time, usually several months or longer.

Drought can be caused by a lack of rainfall, a lack of snowfall from mountains far away or simply when water supplies aren't enough to meet everybody's needs. It starts and ends slowly, and for that reason it has been called a "creeping phenomenon." It's hard to tell when a drought begins and ends, but by watching various indicators of drought, like water levels in streams and reservoirs, soil moisture or the amount of rainfall an area has received, we can keep track of drought conditions.

When drought occurs, it can have serious impacts. That's because water is an important part of so many of our activities. Think about all the ways that you use water every day! Water is needed for people, wildlife and plants to be healthy. We need it to wash dishes, grow food, cool engines and produce electricity. People use water for recreation, swimming, fishing and canoeing. When we don't have enough water for these activities, there will almost always be a negative impact.

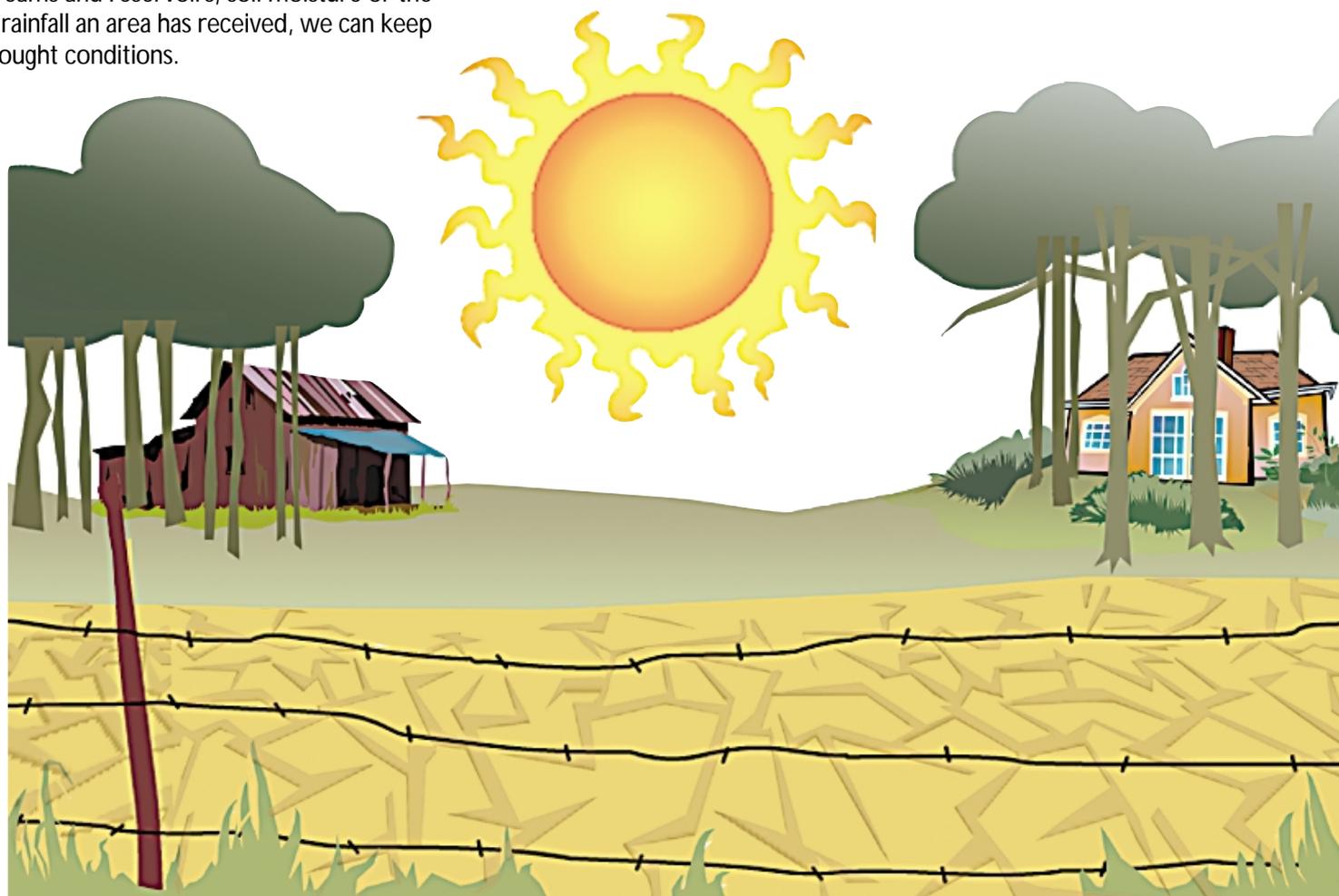
The bottom line is that during periods of drought, the amount of available water is reduced. So, we must use water wisely and conserve it so that there is enough available to meet our basic needs until rainfall amounts return to normal.

Source: National Drought Mitigation Center

In the News

Look in the weather section of today's newspaper. Do you see areas where predicted weather may cause storm-water runoff problems? Is there anything residents there can do to prepare?

Using ads and articles in your newspaper, find products or activities that cause problems for our streams, rivers, or the ocean. List each activity, its cause, potential problems, and action being taken to improve the situation. Can you think of additional solutions to the problem? Which activity do you think will have the most serious effects? Why?



Activity: Graphing Water Levels



Each day for four weeks record the daily rainfall, minimum temperature and maximum temperature for your city. You can find this information from the State Climate Office of North Carolina at <http://www.nc-climate.ncsu.edu/cronos/>. Graph the data using a line graph. Do you see any trends in your graphs? Are any of them relevant to drought? You could also gather this information specifically for your schoolyard. You'll need a rain gauge and a digital thermometer that can track minimum and maximum temperatures. You can get both of these items at your local hardware store. Set them up in your schoolyard. The thermometer should not be in direct sunlight at any time of the day. The rain gauge should be out in the open with nothing hanging over it.

Harvesting Rainwater

Never a Drop to Waste

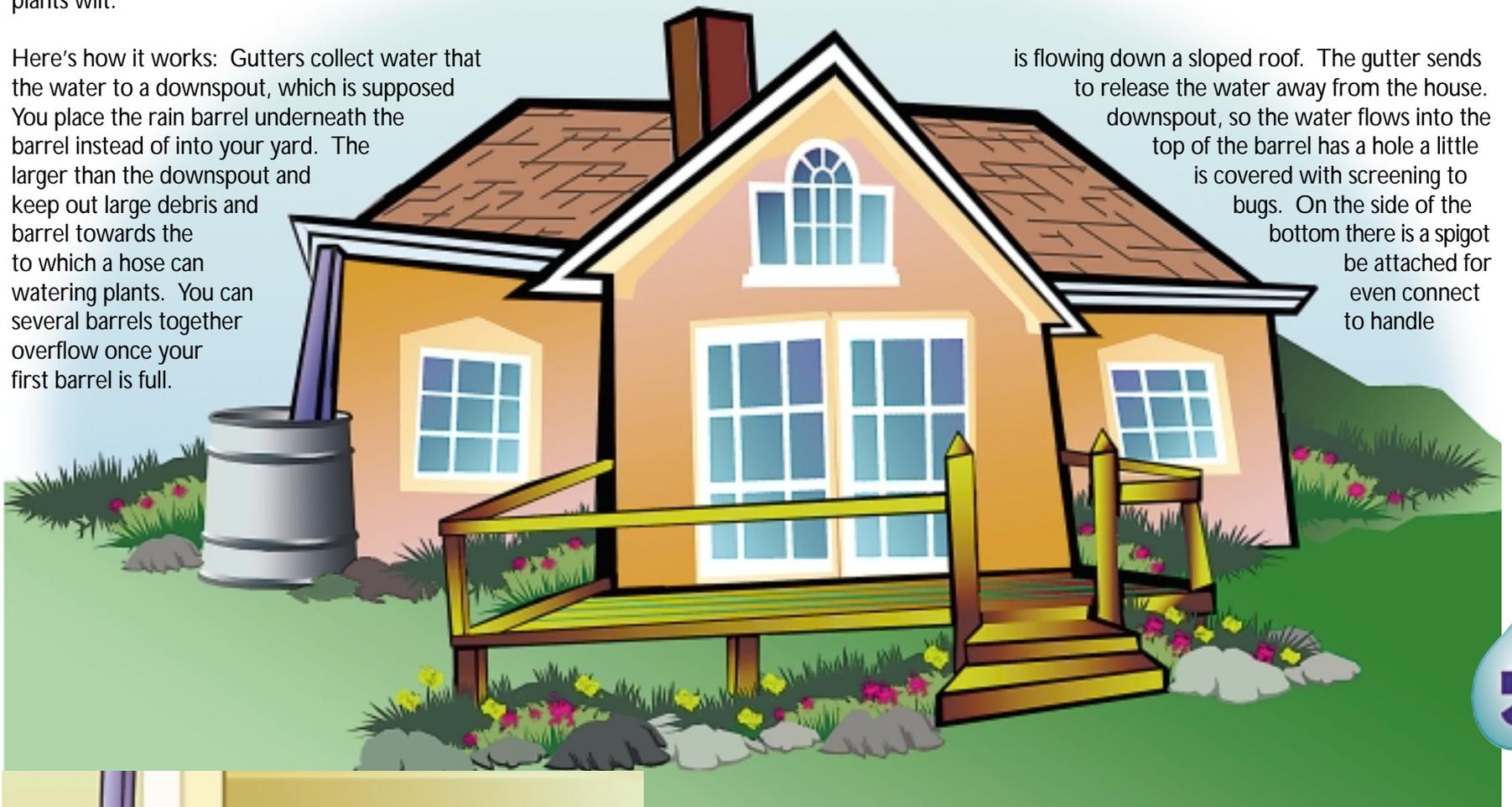
Can you imagine having to carry your water, bucket by bucket, from a spring, well or river into your house or out to the garden? It's quite possible that not too long ago, one of your great-grandparents had to do that every day. A good solution for many folks, then and now, is to catch or harvest rainwater and store it for later use. Storing water keeps potential stormwater runoff from ever reaching the storm drain system, can prevent erosion and lets you save water to use when conditions are dry.

Harvesting Rainwater

Using a barrel to catch water when it rains is one of the simplest, cheapest ways to conserve water. A rain barrel is simply a storage system that captures water running off your roof when it rains. You then have a barrel full of water you can use to water your garden or houseplants, instead of using water that has been treated for drinking. If your city or town bans watering during times of dry weather, it may be the **ONLY** way to avoid watching your outdoor plants wilt.

Here's how it works: Gutters collect water that the water to a downspout, which is supposed You place the rain barrel underneath the barrel instead of into your yard. The larger than the downspout and keep out large debris and barrel towards the to which a hose can watering plants. You can several barrels together overflow once your first barrel is full.

is flowing down a sloped roof. The gutter sends to release the water away from the house. downspout, so the water flows into the top of the barrel has a hole a little is covered with screening to bugs. On the side of the bottom there is a spigot be attached for even connect to handle



Fun Fact:

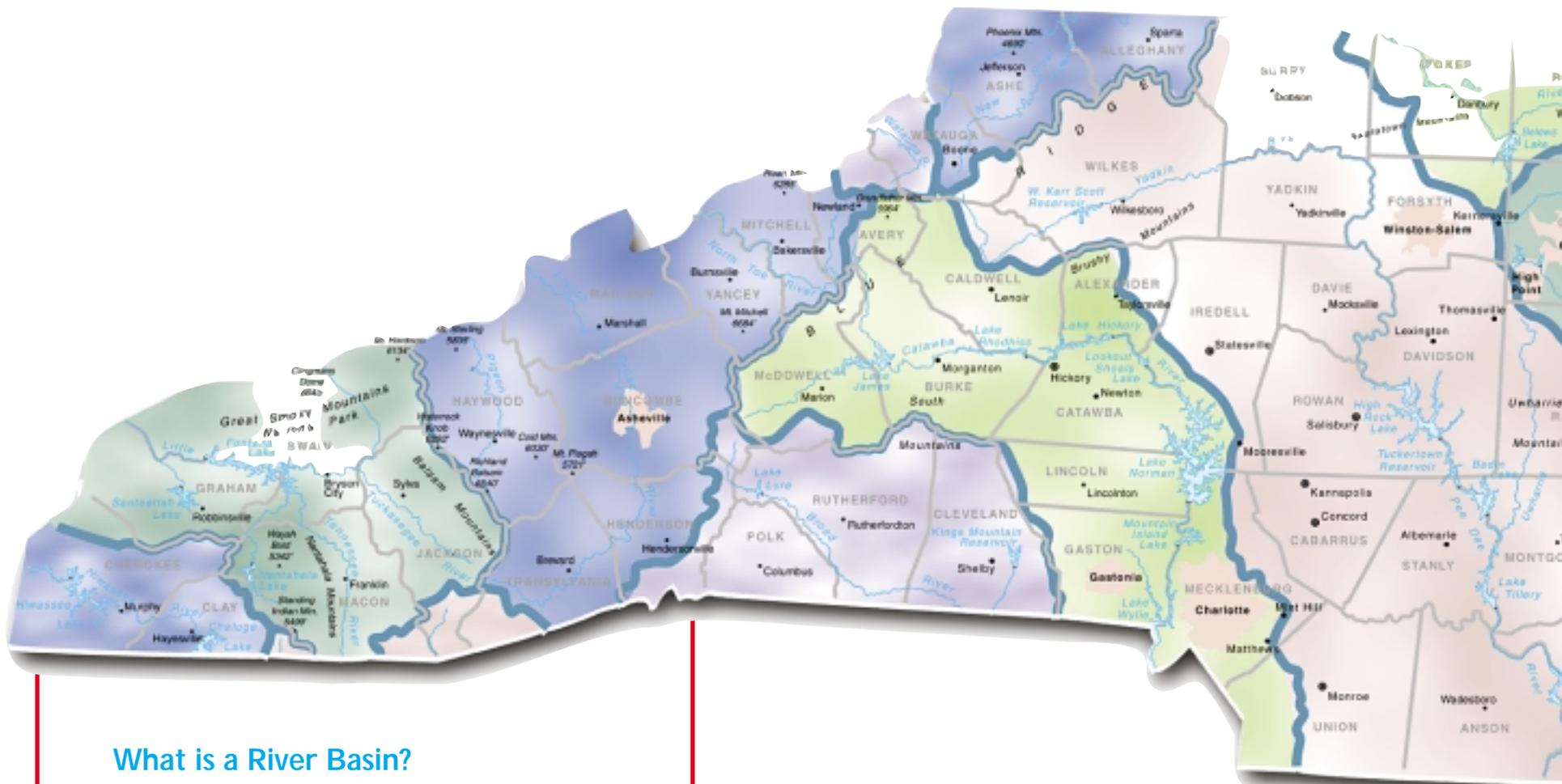
❖ The average residence uses more than 100,000 gallons of water (indoors and outside) each year.

How much water you actually collect depends on how much it rains and the size of the roof. One inch of rain falling on an average house would result in more than 600 gallons of water running off the roof. You could fill more than 18 bathtubs with that much water! Most rain barrels hold somewhere between 50 gallons and 100 gallons of water. An average house would need either a group of rain-barrels linked together or a larger container to capture the water. A cistern may be the solution if you want to harvest as much stormwater as you can. Cisterns are similar to rain barrels, only they hold more water and usually can not be moved once installed. Cisterns can be buried in the ground or attached to the side of the house and are usually attached to your downspout and gutters. They can hold thousands of gallons of water depending on their size.

In the News

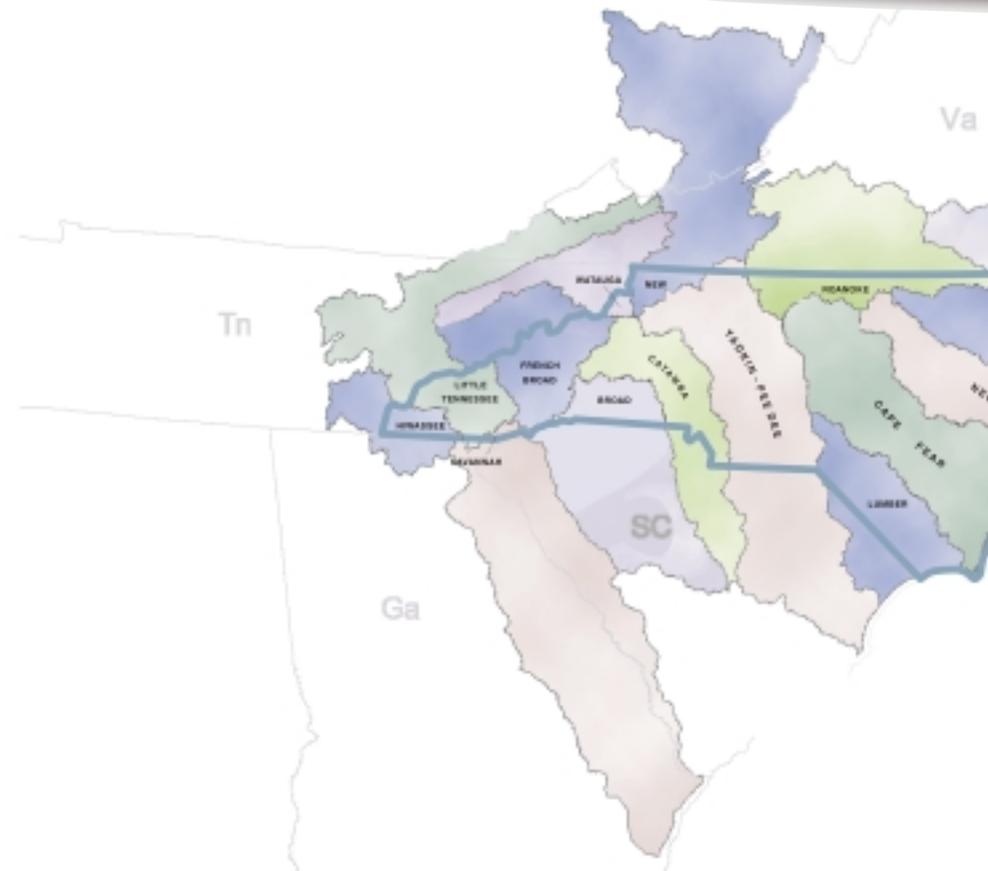
Using your newspaper weather map, find areas of our state or country that are experiencing drought. What measures are being taken to encourage residents to conserve water? Create your own slogan to remind people to use water conservatively?

North Carolina

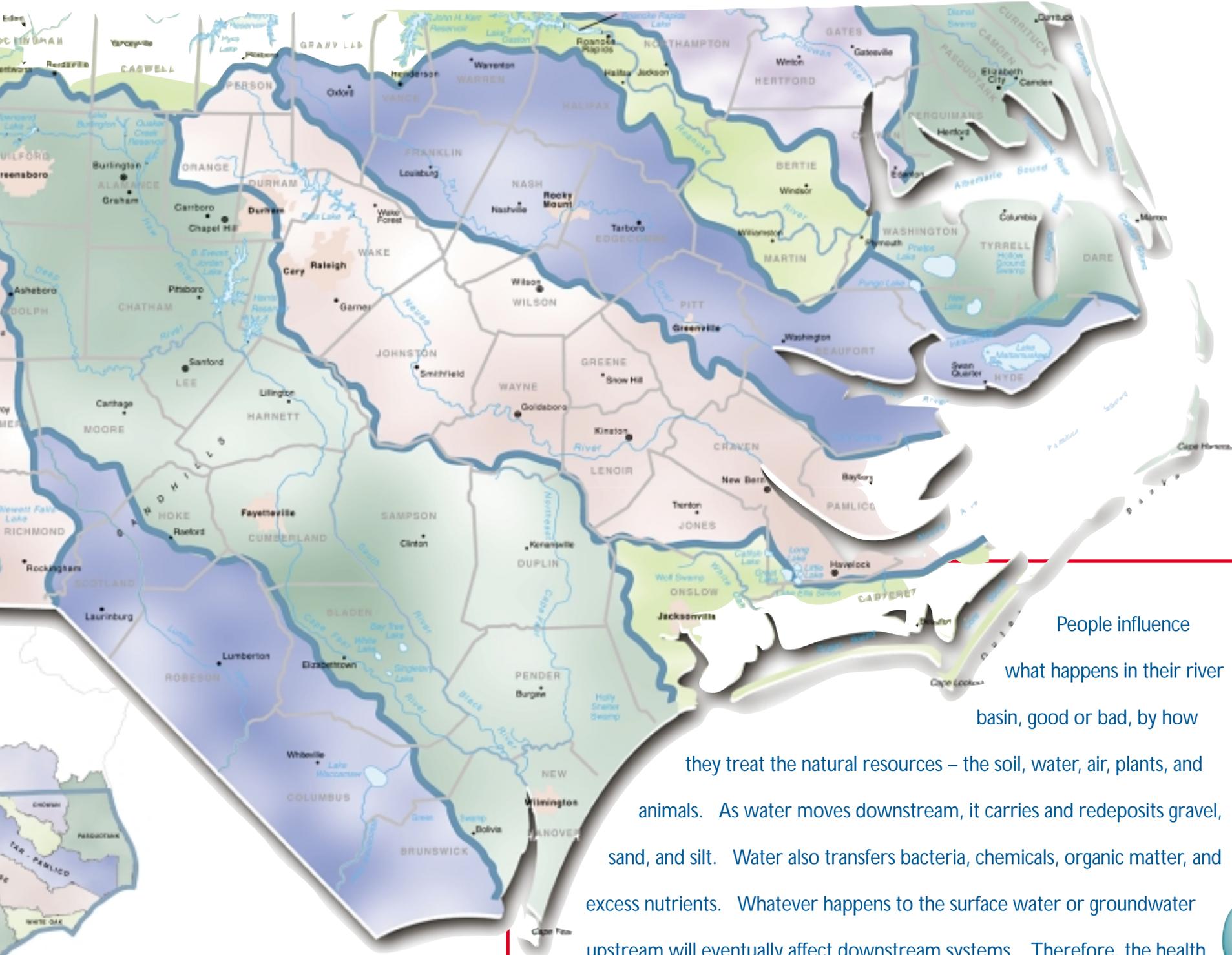


What is a River Basin?

A river basin is the portion of land drained by a river and its tributaries. Everyone in North Carolina lives in one of the state's seventeen river basins. Even if your home is not near a river, the water that falls there drains to a lake, creek, or stream that connects to a larger body of water. Topography determines each of the river basins. Just as a bathtub drains all of the water that falls within its sides, a river basin drains all of the water landing in it to a particular river and then eventually to an estuary or the ocean.



North Carolina's River Basins



People influence what happens in their river basin, good or bad, by how they treat the natural resources – the soil, water, air, plants, and animals. As water moves downstream, it carries and redeposits gravel, sand, and silt. Water also transfers bacteria, chemicals, organic matter, and excess nutrients. Whatever happens to the surface water or groundwater upstream will eventually affect downstream systems. Therefore, the health of the aquatic ecosystem is directly related to activities on land.

A poster-sized version of this map is available through the Office of Environmental Education and can be ordered by calling 1-800-482-8724.

Xeriscaping

Schoolyards and backyards are wonderful places to practice using water wisely. Did you know that with a little work, you can create a beautiful garden that doesn't use a lot of water? You can do this using the principles of xeriscaping (zeer-i-scape-ing). Xeriscaping comes from the Greek word "xeros," which means dry. It's not "zeroscaping," which uses mostly rocks and very few plants to cover the ground. Instead, a good xeriscape design uses plants that can grow in hot weather with only small amounts of water once they are established. The main reason to xeriscape is to conserve water. People sometimes overwater their lawn by as much as 40 percent. Using less water is especially important in drought-prone regions such as North Carolina, but conserving water isn't something to do only during a drought. Any time water is wasted, people like your parents still have to pay to have water treated for use in our houses and yards.

Xeriscaping is based on a few concepts that are fairly easy to put into action as long as you plan ahead when you design your garden area. Where you put plants and how you group them in your backyard or schoolyard is important. The way you water your plantings is important, too. Here are a few basics to remember when xeriscaping:

1. Only use grass in areas where it works best — large, relatively flat stretches of ground. Don't grow grass on narrow paths, along foundations or on steep slopes.
2. Use drought-tolerant, native plants. This means that these plants are adapted to weather conditions in your area. They can stand up to the hot weather that we often have in the summer time.
3. Use mulch. Compost makes wonderful mulch. A two-inch-to-four-inch blanket of mulch helps conserve water by keeping the soil moist. Mulch also protects plant roots from overheating and prevents erosion.
4. Water early in the morning or late in the evening to reduce evaporation. If you use sprinklers, avoid watering on windy or rainy days and adjust them so they do not water paved areas.
5. Use a system that delivers water slowly and directly to the roots of plants. These systems lose little water to evaporation and runoff. A soaker hose is one example of a drip system that brings water directly to plants.
6. Use barrels to collect rain water, and use this water on your yard. Only about one percent of water coming from a water treatment center is actually used for drinking. With a rain barrel, you're not using drinking water on your yard.



Fun Facts:

- ❖ A one acre parking lot causes 16 times more run off than a one acre meadow.
- ❖ On average, 50 percent to 70 percent of the water used by a household is used outdoors for watering lawns and gardens.

Here are a few plants native to North Carolina that will stand up to our summer heat:

Trees	Ground Covers or Vines
Tulip poplar	Trumpet Honeysuckle
Sycamore	Virginia Creeper
Live oak	
Pin oak	Annuals and Perennials
White oak	Black-eyed susan
Sweet gum	Coreopsis
	Butterfly weed
Shrubs	Blanket flower
Yaupon holly	Goldenrod
Strawberry bush	Liatris
Viburnum	Purple coneflower

Source: N.C. Division of Pollution Prevention and Environmental Assistance.



Compost & Grass Cycling

Composting

Have you ever walked in a forest and kicked away a layer of dead leaves? That rich, dark, sweet-smelling earth underneath is compost! Compost is rich, organic soil that is made by microorganisms such as bacteria and fungi. These microorganisms break down leaves, twigs and other organic matter. As the organic matter breaks down into smaller and smaller pieces, plant roots can take up the nutrients. Compost can make grass greener, tomatoes bigger and bushes fuller.



Grasscycling is the natural decomposition of grass clippings left on the lawn after mowing. This process lets you leave clippings where they are cut instead of raking and bagging them. As the clippings decompose, they create a layer of nutrients that keep the soil cool and prevent it from losing moisture. This creates less work for you, saves water, money and time, and recycles nutrients back into the soil. It's a win-win situation!

Source: N.C. Division of Pollution Prevention and Environmental Assistance



Why Compost?

First and foremost, you will keep useful materials out of the landfill. You can use compost instead of chemical fertilizer on garden plants. Compost helps those plants grow and keeps extra nutrients from running into creeks and rivers when it rains. If you use compost as mulch in your garden, it will help the soil stay moist so you don't need to water as much.

than others! To create the right environment for the microorganisms that decompose waste, compost a balanced mixture of brown stuff (dry dead plant material), which is high in carbon, green stuff (fresh plant parts), which is high in nitrogen, air and water. Don't use meat or milk products because pets and other animals may try to dig them out of the ground. Also, avoid diseased garden plants. They can spread disease back into the garden later when you use the compost.

Recipe for Compost

Building a compost pile is like topping a pizza. Many ingredients can be used, but some work better

*You may want to use grasscycling to recycle grass clippings.

In the News

In the news, find examples of daily activities that contribute to stormwater runoff. Come up with a public awareness campaign to let people in your school or neighborhood know what they can do to reduce or prevent stormwater runoff. Design a poster illustrating your message.

Compost		Not Compost
Brown Stuff	Green Stuff	DO NOT USE
Leaves	Grass clippings*	Meat
Straw	Vegetable & fruit scraps	Bones
Shredded paper	Bread, grains, and pasta	Milk products (cheese, milk, salad dressing)
Branches (shredded into small pieces)	Coffee grounds & filters	Fats
Paper towels	Tea bags	Oils
	Crushed egg shells	Diseased plants
	Fresh hay	Pet droppings

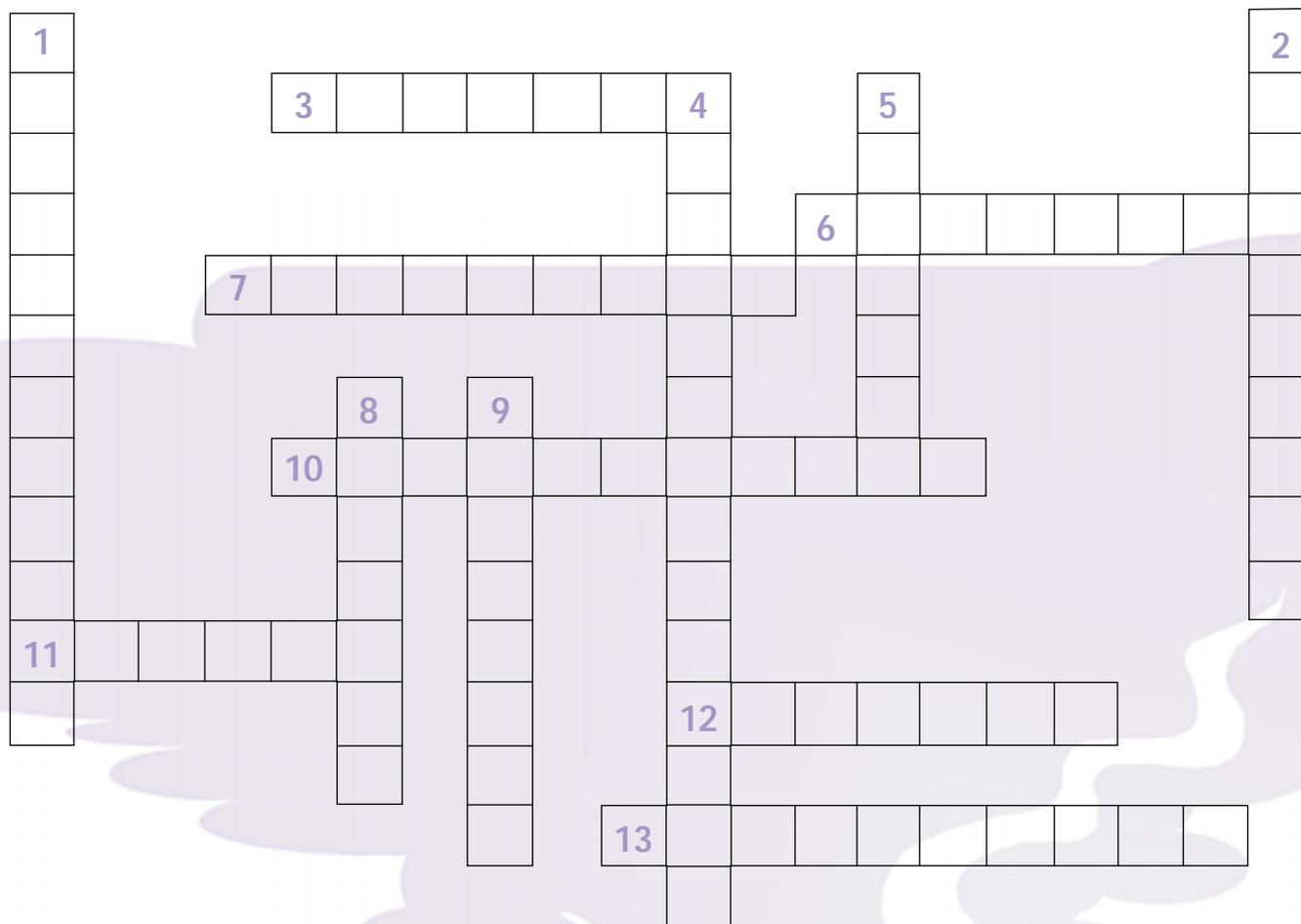
Activity: Classroom Composting



Worms are great at decomposing the food waste that people leave behind. To make a worm bin for the classroom, drill holes in a large plastic container. This will let in air for the worms and allow excess water to drain out of the box. Next, add damp, shredded newspaper to the bin, until it is about three-quarters full. Add a handful of soil to the newspaper. Now, you're ready to add the worms. Red wigglers (*Eisenia foetida*) are recommended. You can find these at a local bait store. It is a good idea to start with between 50 worms and 100 worms. Start feeding your worms food waste slowly to see how much they can handle. Stick to fruit and vegetable scraps, bread products or coffee grounds. Don't feed them meat or milk products! Each time you add food, place it in a different spot in the bin. Keep the bin closed and make sure the worms don't dry out. It is a good idea to keep a spray bottle next to the bin to keep the worms moist. Congratulations, you are composting!

Are You Water Wise?

Solve the puzzle below to test your knowledge about stormwater runoff and water conservation.



Across

3. When there's not enough rainfall to meet our needs for water, we're in a _____.
6. To preserve and renew, when possible, human and natural resources.
7. A substance introduced into the environment that harms the usefulness of a resource or the health of people, animals or ecosystems.
10. North Carolina is made up of 17 _____.
11. _____ plants are good to use in a xeriscape, because they are adapted to the hot conditions in North Carolina.
12. Material that is produced from a process in which microorganisms in soil mixed with yard and kitchen waste break down the mixture into organic fertilizer.
13. A barrel used to harvest rainwater that is connected to a downspout on a house.

Down

1. Process in which grass clippings are left on the lawn after mowing to decompose.
2. Water flows over an _____ surface; it cannot sink into the ground
4. A map showing the physical features of land including elevations and the position of natural and man-made features.
5. The wearing away of the land's surface by wind or water.
8. Tank or storage facility used to store large amounts of water for a home or farm.
9. Prevent floods by soaking up stormwater runoff into the soil then releasing it slowly.

In the News

Find articles about planned or ongoing construction in your area. Are environmentalists concerned about how the construction may affect the environment? Are the builders taking steps to prevent erosion and stormwater runoff? If so, what? How can we as a community balance the need for development with the need to protect our environment? Write a letter to the editor explaining your point of view on this issue.

NC State Standards addressed in Stormwater and You:
 5th grade - 3.01, 6th grade - 3.06,
 8th grade - 3.02, 3.07, 3.08,
 9th grade - Earth Science - 4.04, 4.05,
 AP Earth/Environmental Science - 4.03, 5.02



Glossary

Cistern

Tank or storage facility used to store water for a home or farm; often used to store rainwater.

Compost

Material that is produced from a process in which microorganisms in soil mixed with yard and kitchen waste break down the mixture into organic fertilizer.

Conserve

To preserve and renew, when possible, human and natural resources.

Continental Divide

The line of mountains which separates eastern-flowing water from western-flowing water.

Contour lines

Parallel lines used on topographic maps to show the shape and elevation of the land. They connect points of equal elevation.

Decompose

Break down into smaller and smaller pieces.

Drought

A long period (usually a season or more) of dry weather where less than normal or no rain falls.

Erosion

The wearing away of the land's surface by wind or water.

Evaporation

When the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam.

Grasscycling

Process in which grass clippings are left on the lawn after mowing to decompose.

Impervious surface

A surface that water cannot go through.

Microorganism

An organism that can be seen only through a microscope, including bacteria, algae and fungi.

Native plants

Plants that naturally occur in an area and have not been introduced by human action.

Organic matter

Plant and animal material that is in the process of decomposing.

Pollution

A substance introduced into the environment that harms the usefulness of a resource or the health of people, animals or ecosystems.

Rain barrel

A barrel used to harvest rainwater that is connected to a downspout on a house.

River basin

The land area that drains into a river.

Sediment

Loose soil particles that settle at the bottom of a body of water.

Stormwater Runoff

Water from rain or melting snow that flows across the land and into the nearest stream, river, lake or ocean instead of seeping into the ground.

Topographic map

A map showing the physical features of land including elevations and the position of natural and man-made features.

Watershed

The land area that drains into a common body of water.

Wetland

A land area that is covered by water with plants adapted for life under wet soil conditions.

Xeriscape

A landscape designed to conserve water and use it efficiently.

Standards

North Carolina State Standards - Stormwater and You
Corresponds with these N.C. Standard Course of Study Science Objectives:

5th grade: 2.06, 2.07, 3.01, 3.05

6th grade: 3.06, 4.02

8th grade: 3.02, 3.07, 3.08

Earth/Environmental Science: 2.05, 4.01, 4.04, 4.05

AP Environmental Science: 4.01, 5.04

Quick Tips

- Check for and repair leaky garden taps, hose connections and sprinkler valves.
- Water in the morning or evening, not in the heat of the day, to prevent evaporation.
- Don't water when it is windy.
- Water slowly, thoroughly, and as infrequently as possible to promote deep roots and healthy plants.
- Water the roots of your plant as directly as you can.
- Use native plants that are adapted to the weather conditions in your area and won't need as much water, fertilizer or pesticides.
- Add compost and other organic matter to your soil.
- Leave grass clippings on your lawn to decompose and return nutrients to the soil.
- Compost your yard waste!
- Pick up after your pet.
- Don't dump anything down the storm drain.
- Choose plants that don't need a lot of water.
- Mulch all your plant beds to keep soil moist and cool.
- Make sure your sprinklers are not watering pavement.
- Use a bucket and a hose with spray attachment to wash the car.
- Don't use the hose to clean driveways and sidewalks. A broom will provide more exercise, anyway.
- Use permeable paving surfaces such as wood decks, bricks and concrete lattice to allow water to soak into the ground.
- Plant trees, shrubs, and groundcover around your yard. They can soak up 14 times more rainwater than a grass lawn, and they don't need fertilizer.



Fun Fact:

- ❖ Water is the only substance on earth naturally found in three forms – solid, liquid and gas.

Conservation Station



Conservation Station: What Can I Do?

Can you find at least eight things in the picture above that this family is doing to conserve water or to prevent too much water from running off into nearby creeks and rivers? Circle each activity that prevents excess runoff or conserves water, and then check your answers below. Next, think of at least two ways that you could prevent runoff or conserve water in your own yard at home.

- Answers to Conservation Station**
1. Create a rain garden to catch and filter water from downspouts.
 2. Leave grass clippings on the lawn.
 3. Xeriscape using native plants that tolerate hot, humid weather.
 4. Compost yard and kitchen waste.
 5. Catch rainwater in barrels or cisterns.
 6. Wash the car on a pervious surface.
 7. Create backyard habitat areas that have less lawn.

