

Where the Water Goes



From your yard...



... to the ocean

Why do I care about Water?

WHAT? How can you even ask that question? Water is fantastic! Just see for yourself. Look at the pictures below: How does water make these things possible? When you are done, turn this page upside down for the answers.



A



B



C



D



E



F

Did you get them all? If you didn't, you aren't alone. Few people realize just how important having plenty of clean water is to our everyday activities. Now let's learn more about our water and how we can keep it clean.

Answers to "Why do I care about Water?":

A. This is an easy one, of course you need plenty of clean water to swim.
 B. The kayak would still float on polluted water, but would you want to paddle in it?
 C. Not only does the fisherman need the water on the weekends, but the fish need clean water to live in all the time.
 D. Sometimes we enjoy the beauty of water when we stay on dry land, like on a hike in the North Carolina mountains.
 E. This is a tricky one; did you know that caves are formed by water wearing away the rock over thousands of years? They also act as the underground drainage system for the surface when it rains—you don't want to be in there during a storm! Caves have everything to do with water, and like surface streams they have bugs and fish that require clean water.
 F. Where is the water in this picture? You can't see it, but let's think of all the ways clean water made this scene happen. Water helps the grass grow, quenches the soccer player's thirst, grows the food that gives him energy, cleans the clothes when he is done, even manufacturing the T-shirt itself requires water to irrigate the cotton crops and water to dye the clothing. Did you know that it takes 1800 gallons of water to make one pair of blue jeans? How else do you think that soccer player uses water everyday? How many ways have you used water today?

The Water Cycle

The **water cycle** describes the never ending journey of water as it rains on land, flows to the sea and then returns to the clouds through evaporation. Does that sound familiar? I'll bet you have seen it all in action. Don't believe me? Read on...

Let's start in the ocean. When the sun shines on the ocean, the water near the surface heats up. You already know from seeing a boiling pot of water on the stove that when water gets hot, it turns from a liquid to a gas. That is called **evaporation**. That gas leaves the ocean and becomes the clouds you see in the sky.

Clouds are made of tiny water droplets. When these droplets pack together (or "condense"), they form raindrops and fall to the ground as **precipitation**. Precipitation is just a fancy word for rainfall, and we all know what that is.

When precipitation reaches the ground it can do one of two things: it can soak into the ground or it can flow downhill until it reaches a stream. When rain soaks into the ground, it is called **infiltration**. Water that has infiltrated into the ground moves very slowly through tiny gaps in the soil and can eventually enter a stream or river. If rain cannot soak into the ground, it flows across the surface and is called **runoff**. Have you seen water flowing across a parking lot during a storm? If so, you have seen runoff. That runoff will eventually flow into a stream, then into a river and back into the ocean where the water cycle will start all over again.

This book helps you understand what happens to the water once it falls to the ground and how it gets from your yard all the way to the ocean.

Before we move on, let's see if you can match the words you learned above with their meaning. Place the letter of the correct word in the blank. Each word is only used once.

___ Another word for rain

___ When water soaks into the ground

___ The never ending movement of water through streams, rivers, oceans and back into the air

___ When rainfall flows across the ground instead of soaking in

___ The process by which liquid water changes into a gas

Word Bank

- a. Water Cycle
- b. Evaporation
- c. Infiltration
- d. Runoff
- e. Precipitation

Where does the water go when it rains?

When it rains...

Once rain hits the ground it can get to a stream the slow way or the fast way. The slow way is by soaking into the ground and creeping through the soil. Slow is good because it allows the soil to filter and clean the water. It also prevents all of the water from getting to the stream at the same time. What happens if too much water suddenly drains into a stream? Keep reading...

Where the water goes...

The other way, the fast way, is for the rainfall to stay on top of the ground all the way to the stream. Remember: we call that **runoff**. Is faster better? Not here! When all that water rushes downhill, the stream might not be big enough to hold it all at once and then you have a flood. Runoff can also carry dirt, limbs, trash and other pollutants into the stream.

Stuff can get into the water...

What are pollutants? Oil from parking lots, excessive lawn chemicals, uncovered dirt from construction sites, or soapy water from washing a car are a few pollutants. When pollutants are washed into a stream by runoff, we call it "**Nonpoint Source Pollution**."

The pollution comes from so many places that we can't identify just one point as the cause, and that's why we call it **nonpoint** source pollution. A car leaking oil on a driveway is an example of nonpoint source pollution. By itself, one small puddle of oil in one driveway may not do much harm. The problem is that there are so many driveways and parking lots in a city that all that leaking oil can really add up. And when it rains, that oil can wash into our streams.

Don't Forget your Umbrella!

The impact of a large drop of rain on bare dirt can throw tiny pieces of soil over 5 feet.

While that is pretty impressive, loose soil can cause several problems. We need it to stay put so our gardens, lawns and trees will have plenty of fertile soil in which to grow. If the soil is loose, it can wash into our streams, and that's the last place we need it.

How can you protect soil from such a powerful force? The same way you protect yourself: by covering up. We use pine straw, hay, mulch and even leaves to protect bare soil until we can get grass or other permanent vegetation to grow.



You're Grounded!

We have already learned how the water will get to the stream, but what determines how fast it will get there? Take a look out the window at the different types of ground surface. You might see pavement, dirt, grass and maybe leaves or pine needles if you're near a forest. Differences in the ground's surface will control how water flows on the ground. Let's look at a few examples:

Pavement

Pavement makes travel safe and fast because it is a very durable surface for our streets and parking lots. However, pavement in the wrong place can be harmful to water quality. What happens when rain falls on pavement? Because it is a smooth and water tight surface, rainwater quickly becomes runoff on pavement. That's why we have to be smart about where and how we plan our new roads and parking lots.

Grass

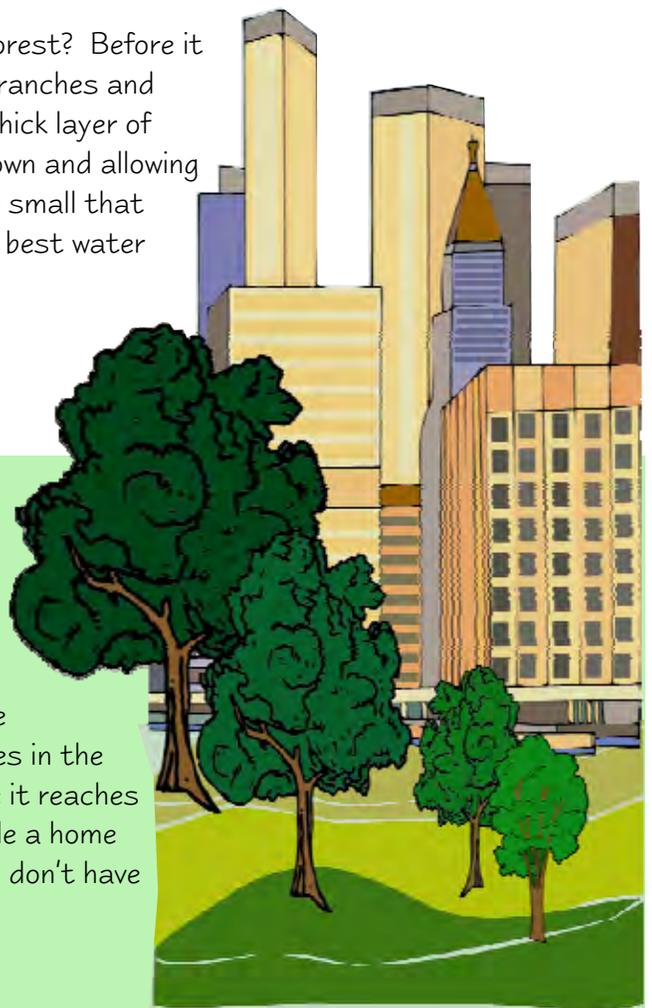
Grass will slow water down far better than pavement and give it time to soak into the ground. However, when we get a lot of rain at one time, grass can't hold it all in place long enough for it to soak in, causing some runoff. Remember, runoff can carry pollutants with it. What pollutant can come from a lawn? Fertilizers that help your lawn stay healthy and green aren't good for our streams. If we are careful with how much fertilizer we use, we can have healthy lawns and healthy streams.

Forest

We have saved the best for last. What happens to rainfall in a forest? Before it can even get to the ground, it is slowed down by the tree tops, branches and leaves. Once the rainfall does get to the ground, it contacts a thick layer of leaves and mulch that act like a big sponge, slowing the water down and allowing it time to soak into the soil. Many times, runoff in a forest is so small that it's hard to see. Since water gets filtered by the forest soil, the best water quality usually comes from the forest.

Trees aren't just for the woods!

Urban areas, such as towns or cities, have a lot of paved surfaces. As you now know, all that pavement can create lots of runoff which can harm streams and cause flooding. City managers are realizing that trees and forests can help fix these problems. By taking care of existing trees and planting new trees in the city, the amount of runoff from pavement can be reduced before it reaches the stream. Plus, trees offer shade, help to clean our air, provide a home for animals, and just make the city a nicer place to be. See, you don't have to live in the country to enjoy the benefits of trees.

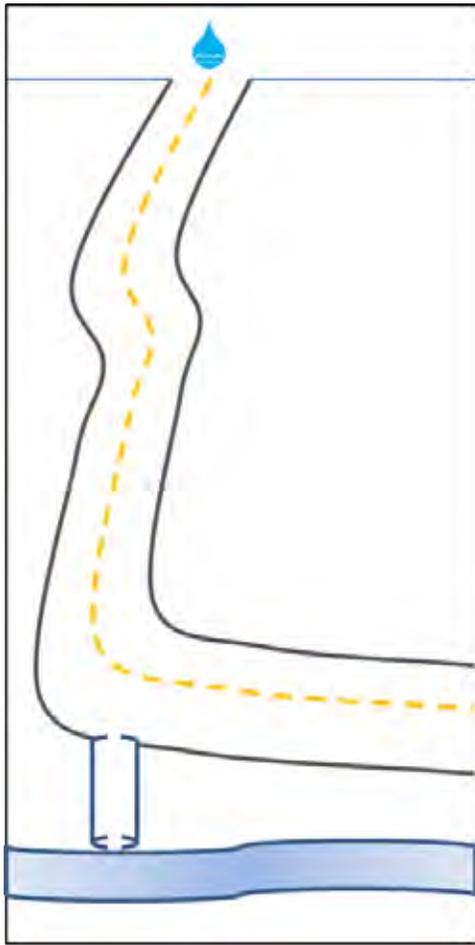


Water's A"maze"ing Journey

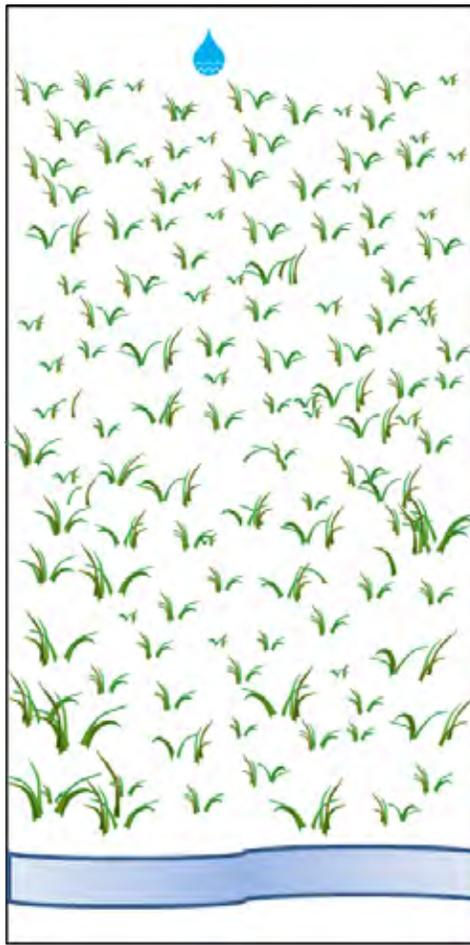
Let's do an activity to illustrate what we have just learned.

You will see three simple mazes below, you must draw a line that connects the water drop to the stream without touching any lines or objects in the maze. Pay attention to how fast you are able to complete each maze.

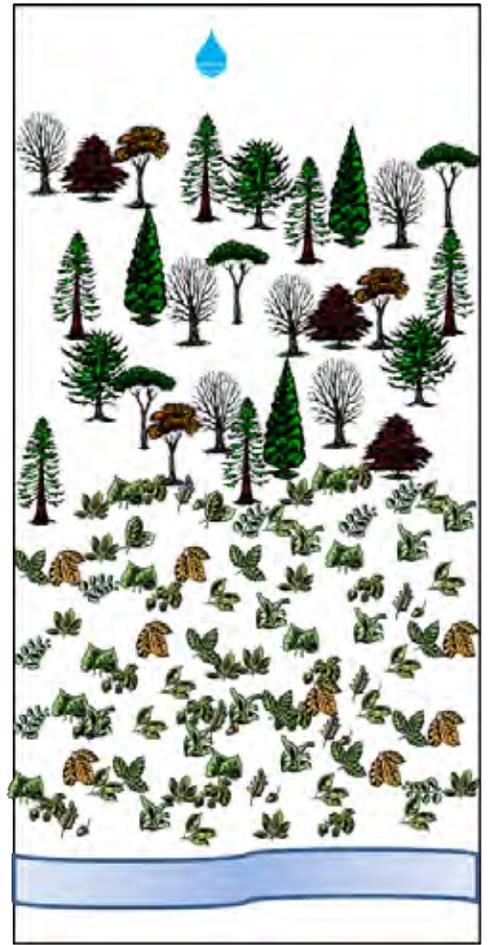
Go!



Pavement



Grass



Forest

Did you pay attention to how long it took you to complete each maze?

Which one was the fastest: pavement, grass or forest? _____

Which one was the slowest: pavement, grass or forest? _____

If you said pavement was the fastest and forest was the slowest, you traveled the same way a real water drop of water might in the same situation. Next time it rains, watch how the water moves across the different surfaces around your house or school. You will be surprised how much you can learn about your environment just through what you see around you.

Forests Work Hard for you!

Clean water isn't the only thing we get from forests. Trees also provide us with many products essential to our everyday life. Read on to find out just how hard our 'Working Forests' are working for you.

Have you ordered from a catalog lately? Enjoyed a concert or a ball game? Written a letter? Eaten a bowl of ice cream? Brushed your teeth? You probably answered "yes" to many of these questions, but you may not know that you couldn't do any of these things without paper or wood.

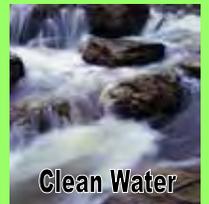
Try to think of something you do during the day that has nothing to do with paper or wood products. Eat? If you enjoyed a piece of fruit today, it's likely that it came from a tree, was wrapped in a protective paper covering and shipped in a cardboard box or a wooden crate. Drink? Many juices comes from fruit grown on trees, and even soft drinks can contain ingredients that come from trees. Drive or rode in a car? The steering wheel in a car contains tree resin. Shower? Shampoo and soap are made with fatty acids found in trees.

In fact, more than 5,000 products that we all use and depend on every day come from trees. The wonderful thing about all of these products is that they come from a renewable resource. Unlike oil, coal, metals and other natural resources used in making products, trees can be planted and re-grown in an endless cycle so that we can enjoy the many benefits they provide -- clean air, clean water, recreation, wildlife habitat and products -- now and in the future.

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Forest Products Game

Let's test your knowledge. Draw a line connecting the pictures of things that come from a forest to the trees. The first one is done for you as an example.



Did you connect all of the pictures? If you did you are correct, each of the pictures above is something that comes from a forest. Aspirin comes from the bark of the willow tree. The wax in your crayon comes from the carnauba tree. And would you believe that a lot of your chewing gum is made with the resin of a pine tree? What our forests provide for us is pretty amazing!

Maps Can Tell You Where the Water is Too!

A map can tell you a lot about your environment. You may have already seen many different kinds of maps, such as road maps, that help you find your way from place to place. When we want to learn about our environment, we often use a special map called a "Topographic Map" or "Topo Map" for short.

A topo map tells you about the shape or topography of the land. Topo maps can also show you where important land features such as roads, rivers, lakes, buildings and even hills are located. Look at the topo map below.

Can you find the pond?

Ponds and lakes are blue.

Can you find the stream?

Streams are blue dashed and dotted lines.

Can you find the building near the pond?

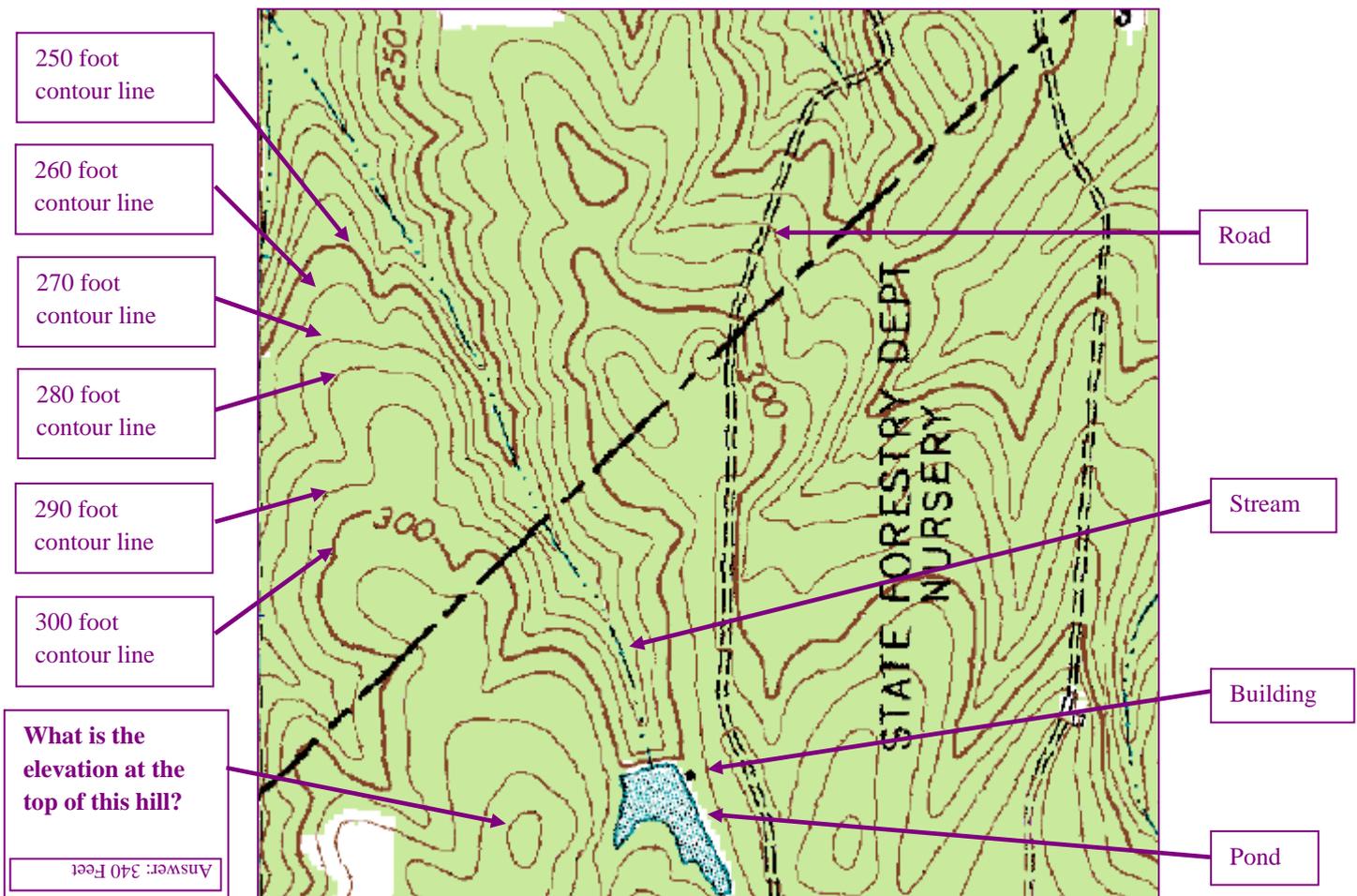
Buildings are small black squares and rectangles.

Can you find the dirt road?

Dirt or 'unimproved' roads are black double dashed lines.

The most important thing on a topo map is all those curvy brown lines. Those lines are called contour lines, and they tell us about the shape of land. Each contour line represents an elevation on the ground. For instance, look at the thick brown line that runs through the "F" in the word "Forestry" written on the map. Trace that line around to your left until you get to the number "300." That means that every place along that line is 300 feet above sea level.

Each line on this map represents a difference in height of 10 feet from the one next to it. This means the line next to the 300 foot line represents 290 feet and the one on the other side represents 310 feet. Do you know which one is which? You can find out by locating the next thick brown line, which is the 250 foot contour line. If you count each line by 10 from that line back to the 300 foot line (250, 260, 270, 280, 290, 300) you will know which way is up and which way is down.



Maps Can Tell You Where the Water is Too!

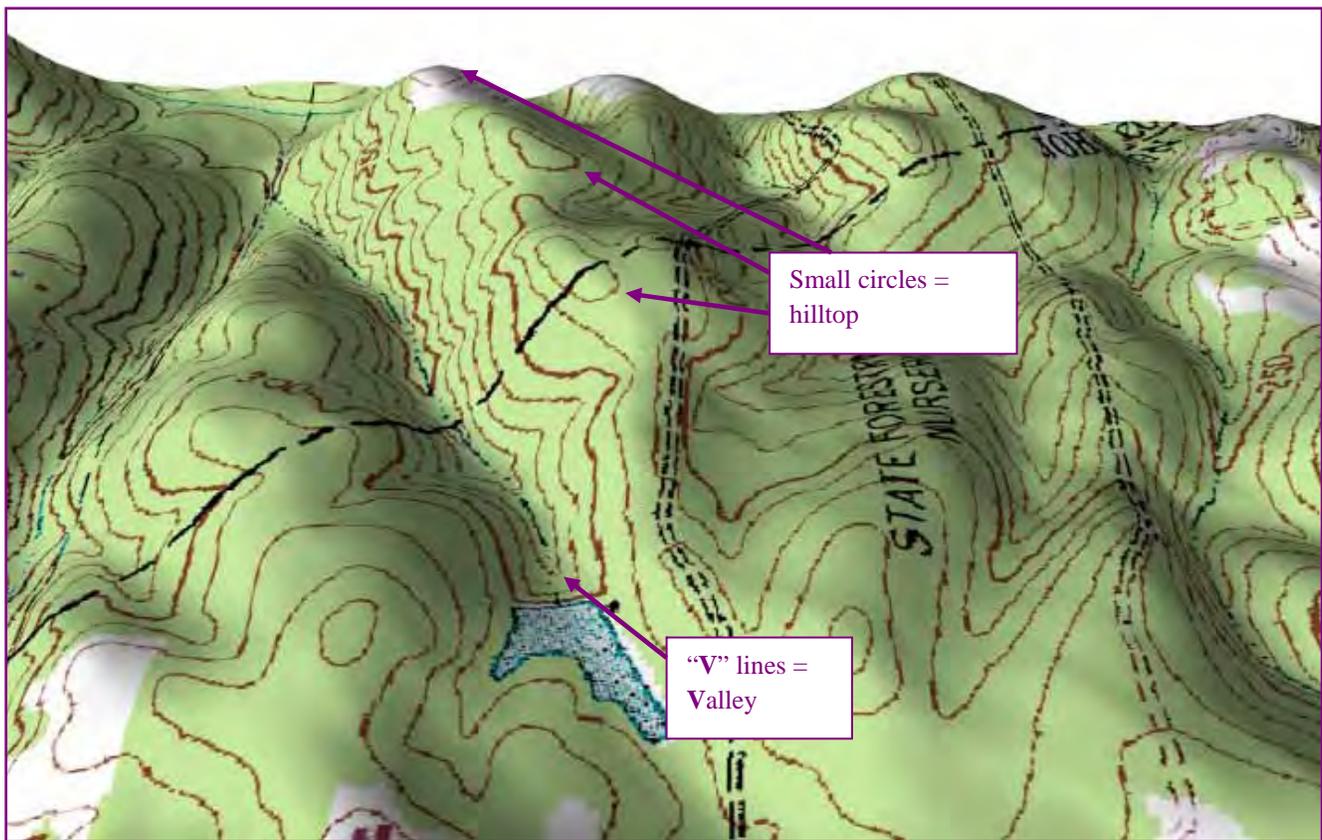
Does this look familiar? It is the same map you were just looking at. It has been enhanced with 3D features to help you understand what the land actually looks like.

Can you see the hills and valleys?

Look how the stream flows right down the lowest part of the valley, just like they do on the ground. You can see that contour lines always make a "V" where there is a valley. Because water always flows downhill, the streams flow right through the point of that "V" in the bottom of the valley.

Do you also see where the topo lines make a small circle? Small circles mark the top of a hill.

Now, look back to the previous page and take a look at that map. You can tell all of this information from a regular topo map, too, now that you know how to read the contour lines.



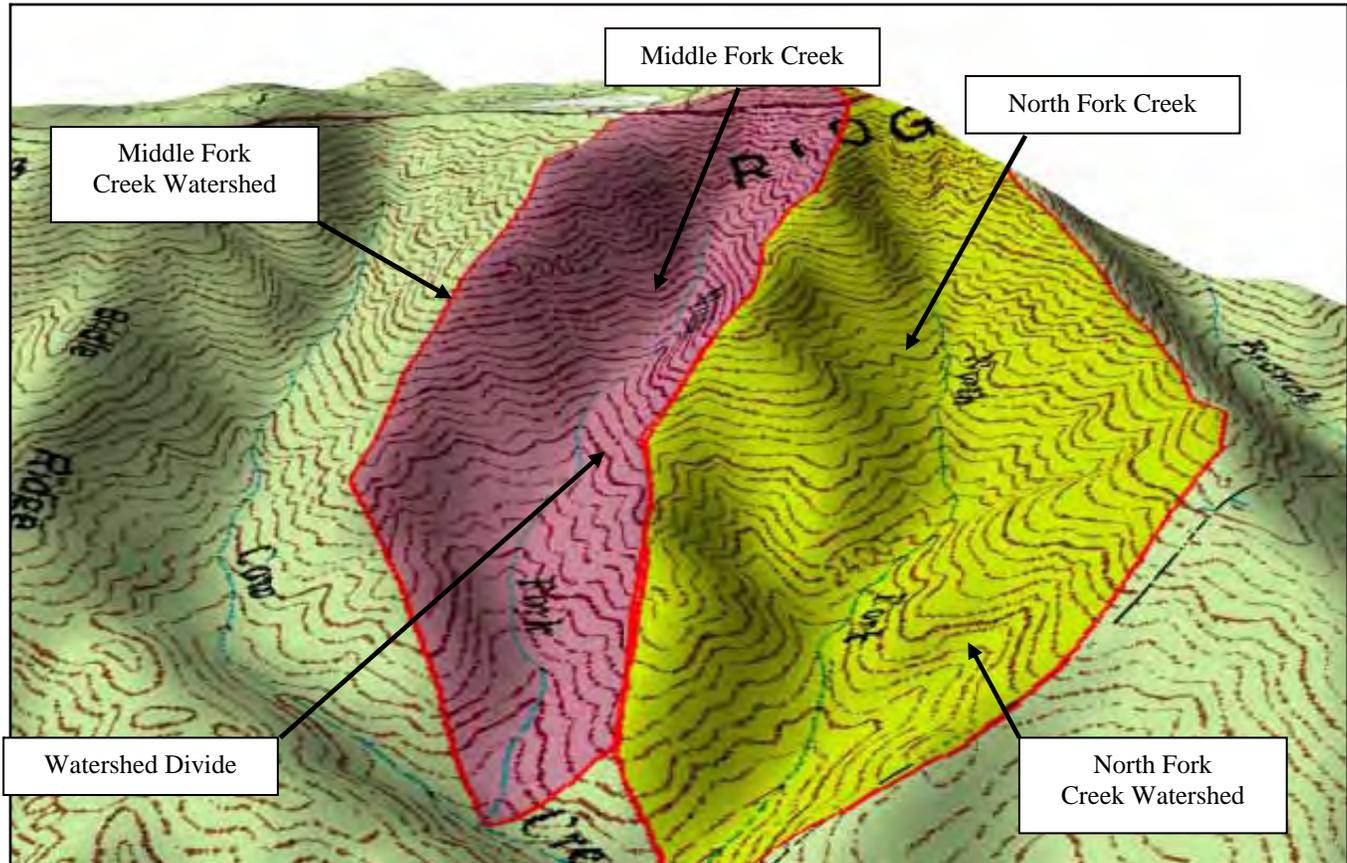
Maps in action

The fire fighters in this picture are using a map to help them fight a wildfire. Using what you know about maps, can you think of things they might be looking for? Here are a few examples:

- 1) Houses that need protection.
- 2) Ponds that can be used as a water source for the fire engines.
- 3) Roads to access the fire.
- 4) Rivers or streams that might act as a natural fire break to stop the fire from spreading.
- 5) Flat open areas where a helicopter can land.

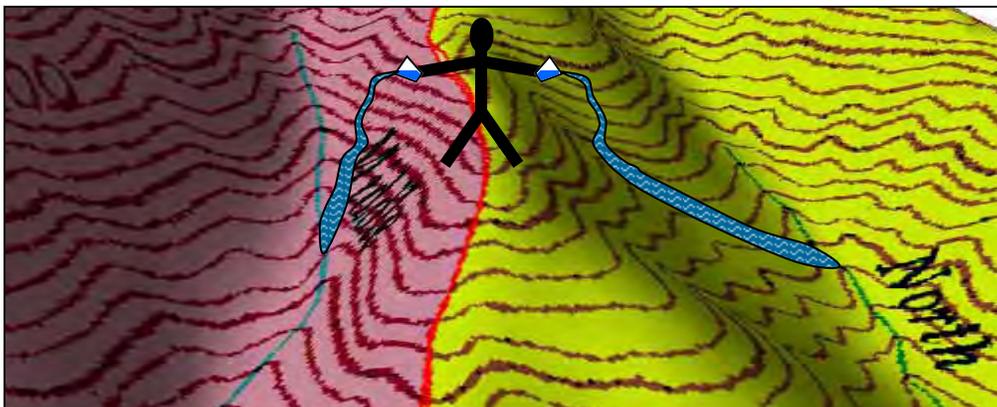


Watersheds



Did you know that every square inch of land eventually drains to a stream, a pond, a river or a lake? It's true! We call the area of land that drains to a particular stream a "**watershed**." Have you ever heard the term **watershed**? Do you see the creek in the picture above labeled "North Fork"? All of the area shaded in yellow is the "North Fork Creek Watershed." That means that any rain that falls in that area could flow down hill and end up in the North Fork Creek. Do you see the creek to the left of that creek? That creek is called "Middle Fork Creek" and the area shaded in pink is the "Middle Fork Creek Watershed."

Now imagine that you are standing on the red line right in between the yellow and pink areas. The top of a ridge that separates two different watersheds is called a **watershed divide**. If you were standing on that divide and poured out a cup of water on your right, it would end up in the North Fork Creek, and if you poured a cup of water on your left, it would end up in the Middle Fork Creek. That's what a **watershed divide** is.



River Basins = BIG Watersheds!

A river basin is just a really big watershed for a whole river. There are many smaller watersheds that make up a river basin. Did you know that there are 17 river basins in North Carolina. Do the word find below and see if you recognize the names of river basins you might already know!

Activity: River Basin Word Find

H A N S A V A N N A H A F H L T P
F B I U G P V T S A N T H I R R T
L Y G H I W A S S E E A G J U J A
B I H P W I G H T P U S F F R K R
G M T C A T A W B A S E S R Q L P
W U O T W O P F M S E K E E W M A
E N W I L H D I Y Q T O S N M A M
T L U M B E R A N U R N N C Y G L
H I J E R Y T R S O K A O H J U I
Z S T R O G F E U T R O M B T A C
E A R Y A N E W N A P R M R S T O
C N X G D M I V E N T E E O A A Y
O H U H E A W F T K E Q L A X W T
P M O I D S E A B M O S C D M W E
U M P W E P A N P I Z L S I J P O
C S O Y A T U W L W H I T E O A K
R D I C F N R Q R S M Z T K E C U
Y T Y A D K I N P E E D E E W N R

Can you find the names of North Carolina's 17 River Basins hidden in the letters above?

Broad

Cape Fear

Catawba

Chowan

French Broad

Hiwassee

Little Tennessee

Lumber

Neuse

New

Pasquotank

Roanoke

Savannah

Tar Pamlico

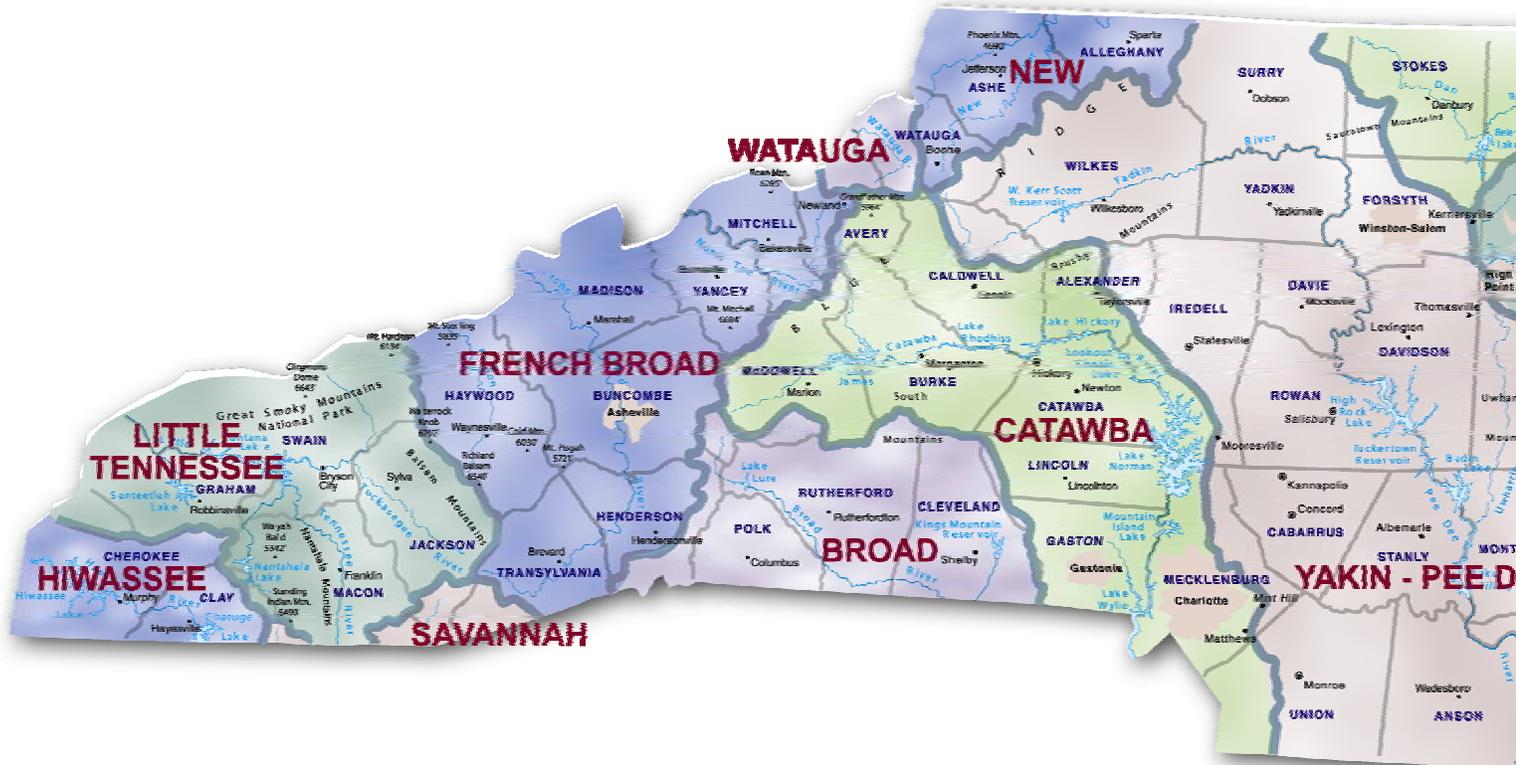
Watauga

White Oak

Yadkin Pee Dee



WESTERN NORTH CAROLINA'S RIVER BASINS



Activity: Know your River Basin

Do you remember that we said every square inch of land eventually drains to a river? This River Basin Map can help you find out in which river basin your home or school is located. Where is your town located on this map?

What river basin are you in?

Write the name of your river basin here: _____

That means that all of the rain that falls in your back yard eventually will end up in that river. Five of North Carolina's major rivers, the Hiwassee, Little Tennessee, French Broad, Watauga and New River, eventually flow into the Gulf of Mexico. All other rivers flow into the Atlantic Ocean.

Where does your river end up? Answer here: _____

Let's answer some questions about other river basins in North Carolina:

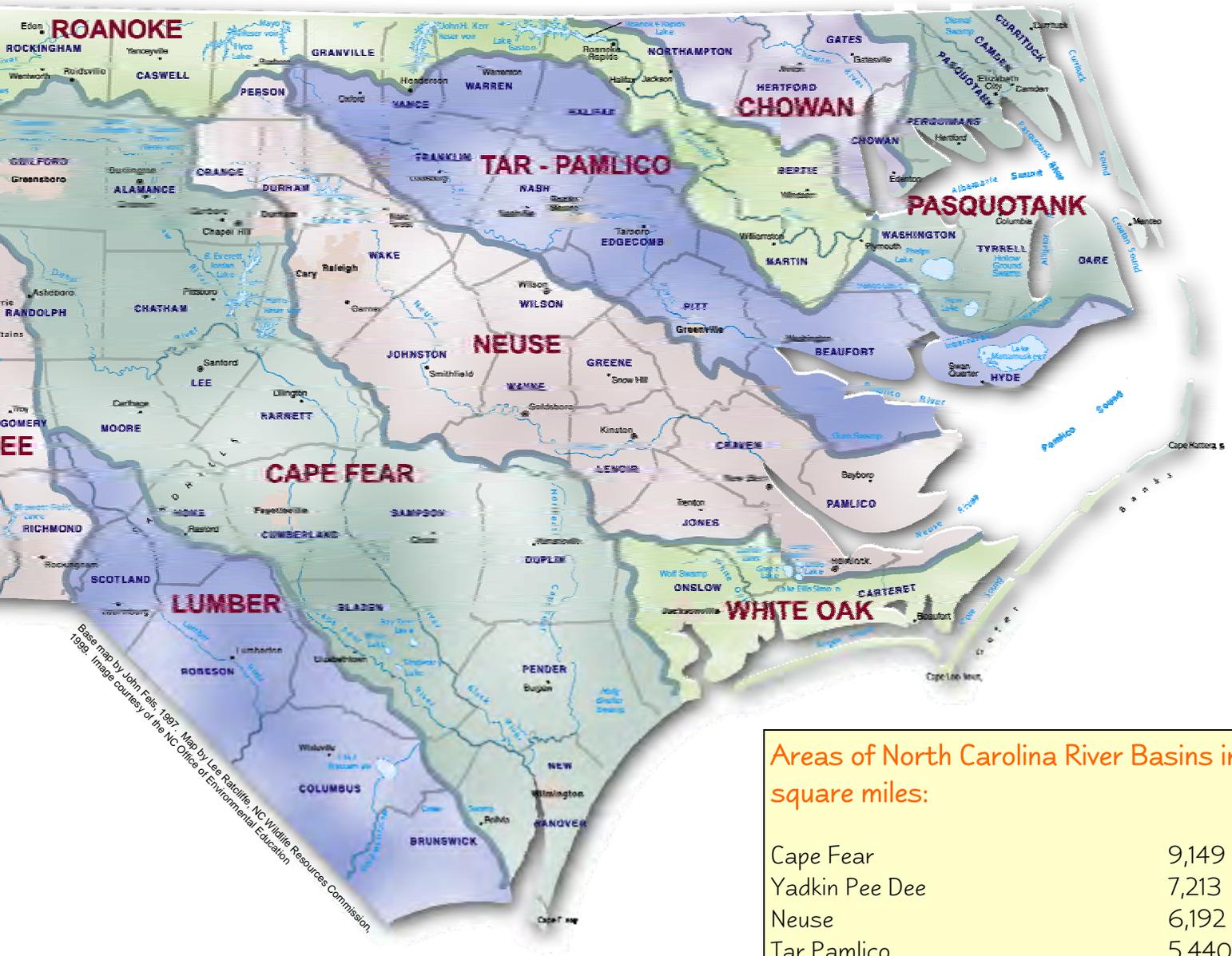
1. Which river basin is the largest? (Hint: Use the yellow box on the right side of this page.)

Answer: _____

2. In which basin is Raleigh, our state capitol, located?

Answer: _____

EASTERN NORTH CAROLINA'S RIVER BASINS

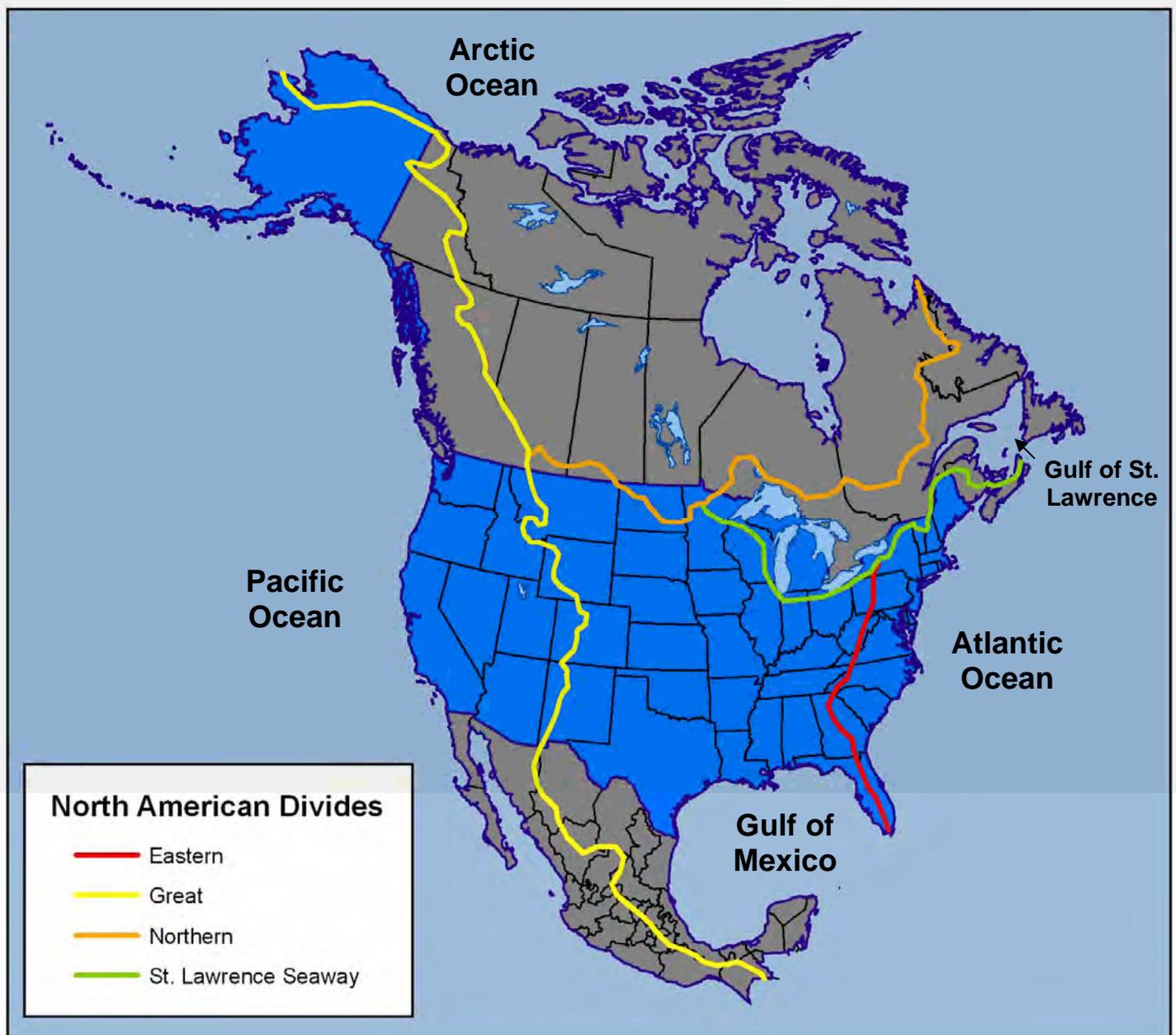


Areas of North Carolina River Basins in square miles:

Cape Fear	9,149
Yadkin Pee Dee	7,213
Neuse	6,192
Tar Pamlico	5,440
Pasquotank	3,697
Roanoke	3,600
Lumber	3,336
Catawba	3,274
French Broad	2,842
Little Tennessee	1,800
Broad	1,506
Chowan	1,315
White Oak	1,233
New	765
Hiwassee	640
Watauga	184
Savannah	151

Continental Divide

Do you remember that we said a **watershed divide** is the place where water will drain into different creeks depending on which side of the divide you are on? Well, a **continental divide** is a place that separates where water will flow to different sides of the continent and into different oceans. For example, the Eastern Divide runs right through part of North Carolina and if you stood right on the line, everything to your right would drain into the Atlantic Ocean and everything to your left would drain into the Gulf of Mexico. That's pretty amazing! If you look at the map below you can see all of the continental divides in the United States.



Your Connection to the Ocean



What did you learn today?

Let's look at the big picture:

Rain that falls in this yard can wash pollutants, such as oil in the driveway or excess fertilizers on the lawn, down to the curb and into the storm drain.

The storm drain will carry the water into a stream that drains the **watershed**...

...which flows into a river in the **river basin**...



...and finally ends up in the ocean!

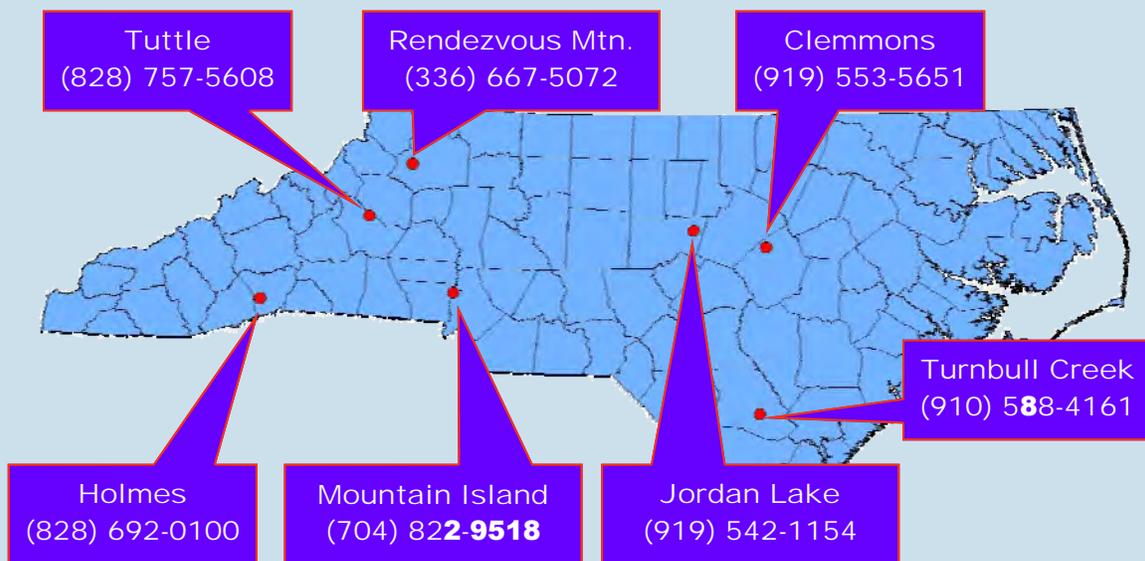
Now that you can see how your yard is connected to our streams, rivers and oceans, you know where you can start to improve the health of our waters—Your own yard!

About the Educational State Forest System

The North Carolina Division of Forest Resources operates a system of seven Educational State Forests (ESFs) designed to teach the public - especially school children - about the forest environment. Since the first ESF opened in Johnston County in 1976, the ESF program has become very popular - so popular that teachers must make reservations months in advance to bring their students to the forest for environmental education classes.

Each forest features self-guided trails that include exhibits, tree identification signs, a forest education center and a talking tree trail. Specially trained rangers are available to conduct classes for school and other youth groups. Teachers or group leaders choose from a selection of 30-minute programs that cover all aspects of the forest environment - from soil, water and wildlife to timber and forest management.

Visit your nearest Educational State Forest today! More information available at: www.ncesf.org



For More Information visit the N.C. Forest Service Website: <http://ncforestservice.gov>



**N.C. Department of Agriculture
& Consumer Services**
Commissioner Steve Troxler

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