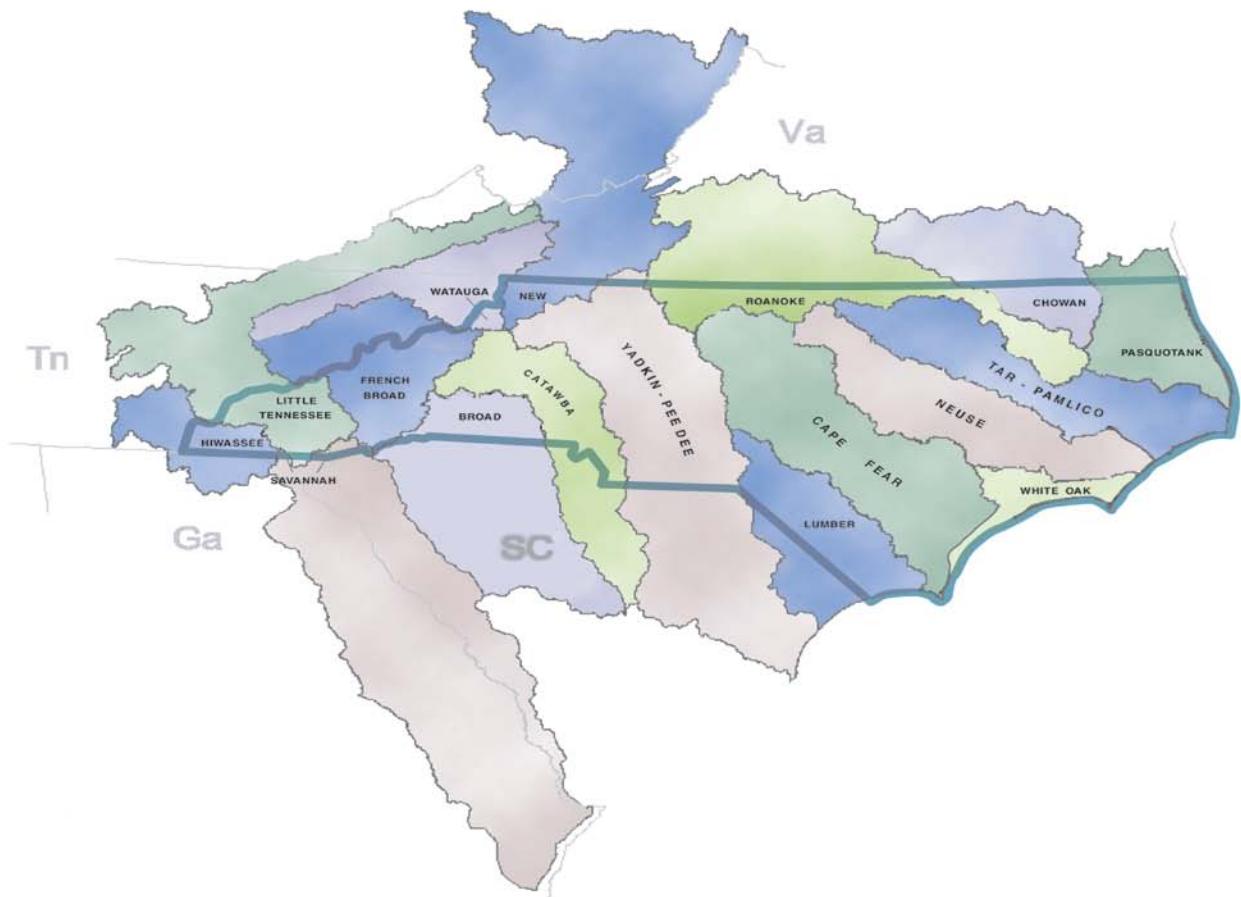


Educator's Guide: Lesson Plans and Activities for the North Carolina River Basin Materials



This document was created by the North Carolina Office of Environmental Education and Public Affairs
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Background:

The River Basin Education Program for the N.C. Office of Environmental Education and Public Affairs has been providing quality publications on the river basins of N.C. since the 1990s. These publications are **free** and have been produced and disseminated across the state through grant funding. Over 100,000 documents have been distributed to thousands of recipients. This document is a compilation of select lessons and activities from educators that have used these publications. This guide can be used in conjunction with River Basin Program materials found in the Resources section on our website. Feel free to download these documents or order hard copies free of charge:

<http://www.eenorthcarolina.org/riverbasins.html>

Correlation to the N.C. Essential Standards:

Originally intended for an adult audience, educators have reported using these materials for grade levels 4 and up. We have found that lessons designed around the publications correlate best to the following N.C. Essential Standards:

- **8.E.1.1:** Local river basins and water availability
- **8.E.1.3:** Predict the safety and potability of water supplies in N.C. based on physical and biological factors
- **8.E.1.4:** Conclude that good health of humans requires: monitoring the hydrosphere, water quality standards, methods of water treatment, maintaining safe water quality, and stewardship
- **EEn.2.4.2:** Evaluate human influences on water quality in N.C.’s river basins, wetlands, and tidal environments

Using this guide:

These lessons and activities were submitted by formal and non-formal educators for various subjects and age groups. Please feel free to use these ideas and adapt them to your curriculum. Education is improved through collaboration and sharing and it is probable that many of the ideas found here have already been built upon such a model. However, we do ask you to please give credit where appropriate if reproducing these ideas in any way.

For ease of use, lessons have been organized into three sections: **8th Grade Science, 9th Grade Earth/Environmental Science, and Various Grade Levels.** But you may find many ideas that you can adapt to your subject/grade level throughout the document. Some are cut and pasted directly into the document; others are linked to our website. *Happy reading!*

8th Grade Science

- **8.E.1.1:** Local river basins and water availability
- **8.E.1.3:** Predict the safety and potability of water supplies in N.C. based on physical and biological factors
- **8.E.1.4:** Conclude that good health of humans requires: monitoring the hydrosphere, water quality standards, methods of water treatment, maintaining safe water quality, and stewardship

“I found the material GREAT....well put together and easy to use both as a main source and as an enrichment for several of my class sessions....thanks for providing the material” –**Maryann Hedges, 8th Grade Teacher**

“Let me emphasize that it has been wonderful to have a resource since our science text (old as they are) do not cover the needed material for our water unit. Thanks again!”
-**Middle School Teacher**

RIVER BASINS, ESTUARIES AND ECOSYSTEMS OF NORTH CAROLINA IN-CLASS PROJECT
By Diane Jackson, 8th Grade Science Teacher

Name _____ Period _____ Date _____

You will be working independently for approximately two weeks to complete this project. It contains 23 activities which you may complete in the order you choose. The folder's activities will count as a test grade. In other words, you will determine the next test grade you earn by completing the number of activities that equates to the grade you want to receive, so work efficiently, thoroughly and to the best of your ability.

As you finish an assignment, bring it to me to be checked and initialed. Be sure to **LABEL** each assignment with the **NUMBER** in the **RIGHT HAND CORNER**. **BE SURE YOUR NAME IS ON EVERY SHEET BY THE NUMBER!!!** You will need supplies such as paper, glue, colored pencils/crayons etc. **You are responsible for keeping all work in your folder in numerical order! You may leave your folder in the appropriate box at the back of the room.**

Objectives

- *To explain the structure of the hydrosphere including: Local river basins and local water availability.
- *To evaluate the estuaries and river basins of North Carolina as they exemplify the fact that they are reservoirs of nutrients, minerals, and life forms.
- *To evaluate the value and sustainability of North Carolina's wetland ecosystems.
- *To illustrate how terrestrial and aquatic food webs are interconnected.
- *To describe how humans are affecting water quality.

Activities

Use the *Discover North Carolina's River Basins* Booklet to complete the following activities:

1. Discuss in writing four reasons environmental education is important.
2. Create a cartoon that illustrates the reasons environmental education is important. Color the cartoon.
3. Use a graphic organizer or thinking map to illustrate what issues brought the value of rivers to the public's view and the results of this awareness (what happened as a result of these two issues)?
4. Identify and explain four reasons why understanding rivers and river basins are important. Use a thinking map or graphic organizer of your choice to illustrate this.
5. Use a sheet of paper to create a flip chart in which you define fully and illustrate the following terms: river basin, estuary, watersheds, groundwater, and ecosystem.
6. Draw, color and label the water cycle. What are the various places in which precipitation can fall? Where are the places it can end up before it evaporates back into the atmosphere?
7. Create a flash card that illustrates what a river is and why rivers are important.
8. Make a concept web that illustrates the following:
 - a. *What things positively affect the health and water quality of a river? How do they do this? What are the effects of this?
 - b. *What things negatively affect the health and quality of a river? How do they do this? What are the effects of this?
9. Decline in water quality led to government involvement. Discuss some of the outcomes of this. What did North Carolina do in response to this? Write in paragraph form.

8th Grade Science

10. Draw a vegetative/riparian buffer and a non-vegetative buffer. Below the picture, explain how each affects runoff into the river and the plants and animals living in the river.
11. Identify non-point source and point source (define, tree map to classify the two types of pollution).
12. What can you do to protect your water basins? Create a pamphlet that you could pass out that would encourage others to help protect these valuable areas.
13. North Carolina has 17 river basins. Draw North Carolina and color each of its river basins a different color. Locate your river basin and use a Sharpie to outline it in black.
14. Our text talks about watersheds. On page 42, in the textbook, the largest watershed in the United States is pictured. Draw, label, and color America's largest watershed. Label the *continental divide*. Beneath the picture do the following: Define watershed, define divide, and explain what the "continental divide" is.

Use the "Our Living Estuaries" packet to complete the following activities:

15. Read the "Introduction to Estuaries" and label the factors upstream that can affect the estuary.
16. Complete the "How Are You Connected to the Estuary" activity. When you have finished, color in blue the river basin from which we get our water supply.
17. Read the "Estuaries are Habitat" article. Draw, color, and label an estuary which includes all five of the habitats described in the article. Below the picture of the estuary, draw the plants and animals that might be found in the various five habitats. Use a colored pencil or pen to connect each plant or animal to each habitat in which they might be found.
18. Read the "Food Chains" activity sheet. Google search the plants and animals listed that can be found in estuaries. When you are done, draw as many food chains as you can on a sheet of paper. When you've finished, place the members of your food chain in the appropriate level of the circular graphic organizer provided.
Ex: zooplankton → hard clam → common sea star
19. Use the directions and paper provided to create an origami sea turtle.

Use the "Wetlands: Their Functions and Values in Coastal North Carolina" to do the following:

20. Read the article and use a tree map to classify the functions of wetlands in North Carolina.

Use the "Yadkin-Pee Dee River Basin" Article to complete the following:

21. Complete the Get to Know Your River Basin activity.
22. Use a piece of construction paper to make a folder for your activities. Be sure to illustrate & color it.
23. Parent Signature on this project contract.

THESE ACTIVITIES MUST BE COMPLETED INDIVIDUALLY. IF YOU ARE EXPERIENCING PROBLEMS, COME AND ASK ME TO GIVE YOU CLARITY ON WHATEVER ISSUES ARE TROUBLING YOU. HAVING YOUR PARENT/GUARDIAN SIGN ON THE LINE BELOW WILL EARN YOU ACTIVITY #23!

Parent's/Guardian's signature _____

Contract and Grading Rubric by Diane Jackson

I, _____, wish to earn a(n) _____ on this project in Science. I understand that I **MUST** work on this project in class; although I can do some work at home, over the next two weeks. I also understand that I **AM RESPONSIBLE** for keeping **ALL** my work in my **FOLDER**. I also understand that I am expected to do my **OWN** work. ***It is understood that I will only get full credit for each assignment that is completed accurately, thoroughly, and neatly.***

Student Signature _____
 Period _____ Date _____

Last day to turn in activities: _____ (letter grade reduction if late)

Grading Scale:

A = 23-22 activities	B = 20 to 21 activities	C = 17 to 19 activities
D = 15 to 16 activities	F = under 14 activities	

Units completed and turned in:

#1	#2	#3	#4
#5	#6	#7	#8
#9	#10	#11	#12
#13	#14	#15	#16
#17	#18	#19	#20
#21	#22 Folder illustrated		#23 Parent Signature on Project

As you complete each activity, write the date on which you finished it next to the corresponding number in the above chart. Be sure to leave enough space for me to initial next to it! Bring the work to me to be checked and initialed. ****ANYONE NOT WORKING ON THE ASSIGNMENT QUIETLY AND CONSISTENTLY EACH DAY IN CLASS WILL GET 5 POINTS DEDUCTED FROM HIS/HER FINAL GRADE FOR EACH DAY S/HE DOES NOT PARTICIPATE APPROPRIATELY. NO EXCEPTIONS!**

Parent/Guardian signature _____

 **River Basin Presentation, Cecelia Leonard, Guilford County Schools**
<http://its.guilford.k12.nc.us/act/grade8/act8.asp?ID=896>

As a member of a committee that manages a particular water basin, you are to develop a presentation to a group of investors. The investors are searching for an area in North Carolina to create an outdoor camp for young people in middle and high school. This camp is to educate the young with knowledge of plant and animal life while enjoying outdoor activities like camping, rafting, swimming, hiking, etc. Since this endeavor is funded by the National Science Foundation, the participants will have to show gained knowledge in animal habitats, environmental conservation, and effects of urban growth and pollution on the river basin. Obtaining the contract for this camp is very important for your area. It will mean government money for future projects and a certain amount of stability in land use. This would also mean a growth in jobs in your area.

Your presentation is to introduce the investors to your river basin and to show why it would be the most attractive place for the camp. **Now, go for it! Win that contract!**

Directions for Power Point Project for River Basins:

1. One group member should open Internet Explorer and go to <http://www.eenorthcarolina.org/riverbasins-interactive.html>
2. One group member should open Power Point to begin the presentation.
3. Choose blank layout for the 1st card.
4. For your first slide, go to Textbox at bottom. Title should be about 36 font (name of your river basin). Members of your committee should also be listed on this slide in smaller font. Be sure to center title.
5. Add pictures and script to at least 5 other slides (see Summary of Slides for guidelines).
6. Last slide should have your summary points with your internet source
<http://www.eenorthcarolina.org/riverbasins-interactive.html>
7. Save your work.

Summary of Slides:

1. Title of river basin and committee members
2. Location of river basin, main tributaries
3. Animal Life
4. Plant life
5. Human population, large cities
6. Pollution concerns- What is being done for conservation?
7. Summary of positive features
Web-site used for research (small font)

 **River Basin Questions, Maryann Hedges, 8th Grade Science Teacher**

This first set of questions is used in conjunction with the *Discover North Carolina's River Basins* booklet:

1. What is a river basin?
2. What determines the health of the aquatic ecosystem?
3. How many river basins in N.C.?
4. What river basin do you live in?
5. How big is our river basin?
6. Draw and label the parts of the water cycle.
7. What are the nine components of your ecological address?
8. How is pollution classified?
9. What is a vegetative buffer?
10. Name four programs that are making a difference in N.C.
11. Why are some of the river basin boundaries different now?
12. What can you do to help maintain healthy water?
13. What "crises" made us take a closer look at N.C. rivers?
14. What is carried in water?
15. What is the difference between wetland and groundwater?
16. How can streams be physically manipulated?
17. What led to the government getting involved in the treatment of water?
18. Using the scale map on page 12 estimate the length of N.C. at its longest point.

These questions are used with the Pasquotank brochure:

1. What percent of the water is contained in the Pasquotank river basin?
2. What characteristics are unique to the Pasquotank river basin?
3. What are the "lesser" treasures of this area?
4. What president drained the dismal swamp?
5. The dismal swamp started out as 2,000 square miles how much land has been lost over the years?
6. What was the foundation of the Atlantic Inter-coastal Waterway?
7. What two turtle species are listed as threaten?
8. What is the primary water quality issue in the basin habitat?
9. What water issue comes with the development of beach communities?
10. Compare the Pasquotank to the French Broad (I used these since that is the area we will visit with the students)

River Basin Google Presentation, Submitted by Sam Sirois, Adapted from Online Materials

Students work in teams of 4 to research a particular river basin of their choosing from N.C. They look through the brochures to make their decision. As a team they create a Google presentation. Each student selects their area of focus for their river basin:

- 1) Counties & rivers
- 2) Man's impact
- 3) Flora & fauna
- 4) Headwaters, delta/mouth & landforms

The students use the brochure about their river basin and the internet to create between 5-10 slides about their focus area. As a group they teach the rest of the class about their river basin using their Google presentation. We take 5 class periods to do this as I am also teaching them how to use Google presentation and how to animate slides. I adapted this lesson from projects I found other teachers using online.

Water Quality Education, Airlie Gardens, New Hanover County

Airlie Gardens (part of New Hanover County Parks, Gardens & Senior Resource Center Department) developed curricula for 8th graders studying water quality. The curriculum includes pre- and post-visit activities, a document specific to Airlie's aquatic resources, and more information about the Cape Fear River Basin. One of the eight stations described in their on-site field trip includes a discussion and study of the N.C. River Basins Map. Students are introduced to Cape Fear River Basin, the largest of 17 basins in the state. *Students identify municipalities and land use in the river basin (i.e. agriculture) and discuss how those human developments impact water quality across the river basin. One of the post activities includes stakeholder discussion cards to be used for a mock community forum on water quality impacts across the basin.*

These resources can be found here: <http://web.eenorthcarolina.org/resource/about.aspx?s=65287.0.0.37430>

River Basin Riddler, Office of Environmental Education and Public Affairs

This activity includes teacher instructions, a vocabulary list, riddle questions and clues, riddle cards for the students, and a blank map for filling in river basins and other important features. It utilizes the river basins map and the accompanying riddler cards.

This can be found on our website here:

<http://web.eenorthcarolina.org/net/content/go.aspx?s=105459.0.108.37430>

9th Grade Earth/Environmental Science

- [EEn.2.4.2](#): Evaluate human influences on water quality in N.C.’s river basins, wetlands, and tidal environments

“I use the materials every semester with my classes and find them invaluable for teaching the concept of watersheds and the environmental issues within them.” –Jessica Ricketts, High School Science Teacher

 **River Basin Presentation and Local Water Supply Planning, Kerry Piper, Earth & Environmental Science, Apex High School**

2.3.2b N.C. River Systems

Course: Earth/Environmental Science

Objective: 2.3.2b Explain river systems including N.C. river basins, aquifers, and watersheds.

Essential Questions: How are North Carolina river basins different? Why is it important to protect them?

Materials needed:

- Exploring North Carolina Set 2: Basin Basics (DVD)
- Copies of Basin Basics viewing guide
- N.C. River Basins Map
- Set of N.C. River Basins brochures

Video (~25min)

- Show “Exploring North Carolina: Basin Basics” for an overview of N.C. River Basins.
 - DVDs were provided free to all N.C. schools. Video is also available [online for download](#) but can be slow on school connections.
- Students will complete [viewing guide](#) from N.C. Museum of Natural Sciences:

Activity (~55min)

- Explain that students will be researching the N.C. river basins in pairs and then sharing their information with the rest of the class.
- Each pair will read the brochure about one of the 17 river basins in N.C.
 - Make sure at least one pair has the river basin for your area!
- Students will then answer the following questions projected onto the screen:
 - What is the name of your river basin?
 - Where is the river basin?
 - How many miles of streams and rivers are included in the basin?
 - How many people live in the basin?
 - Describe the river basin (at least 5 more sentences)
 - Describe an environmental issue in the basin and what is being done about it (at least 5 sentences)
- Students will then make a brief presentation to the rest of the class regarding their river basin.
 - Students should point to their river basin on the N.C. River Basins map to give other students in class an idea of where the basin is located.

2.4.1c Local Water Supply Planning (<http://www.ncwater.org/>)

2.4.1c Evaluate the effects of population growth on potable water resources. Infer future effects.

While completing that activity, the kids point out the three river basins where we get our water using the **N.C. River Basins map**

Questions:

1. What is the water system name?
2. How many miles of distribution line are included in this water system?
3. How much water can be stored in the elevated water towers?
4. Does the water system use a leak detection program?
5. Which river basins does the water come from? What percent?
6. What percent of the water is used by residents each day? What percent is used by commercial, industrial, or institutional uses each day?
7. Which months use the most water?
 - a. Why do you think we use more water in these months?
8. What surface source does our water come from?
9. How much water does the system withdrawal each day on average?
10. How much waste water is discharged throughout the year?
11. Which month has the highest water discharge?
12. What is the current population in the area served by this local water supply?
13. Is the population expected to grow or shrink over the projected time period?
 - a. How much will the population change between now and 2020?
 - b. How much will the population change between now and 2030?
 - c. How much will the population change between now and 2040?
 - d. How much will the population change between now and 2050?
 - e. How much will the population change between now and 2060?
14. How is the change in population expected to impact the water demand?
15. Are there plans for additional waste water treatment?
16. In what year will the total demand for water exceed the current available supply?
17. What future supply will be accessed?
18. What other areas contributed to water use planning?
19. Were any reports or studies used for planning?
20. Bonus: How many people do you think contributed information to create this water supply plan? List some of their jobs.

 ***River Basin Poster, Jessica Ricketts, 9th Grade Earth & Environmental Science***

Students create a poster with a partner. I give each student a river basin card (http://www.ncstormwater.org/pages/workbook_riddler_cards.html) and then they get their matching river basin pamphlet and read it.

These directions are on the board for the poster:

- * Copy the N.C. state map and shade the area of your river basin
- * Draw one unique plant/animal that lives in your river basin
- * List several important places/landforms in your river basin
- * Describe 5 environmental issues within the basin (stormwater runoff, sedimentation, etc)

They then present these, holding the large river basin poster to point out their watershed. I have them describe a solution to one environmental problem during their presentation.

 ***River Basin Brochure Template, Letisha Kirby, North Brunswick High School***

This template was designed to be used in conjunction with the River Basin inserts. Students use the inserts to read about their river basin and then fill in the brochure template. It has the student include things such as basic information about their basin, the ecological significance, and environmental issues or problems and possible solutions.

It can be found on our website at the following address:

<http://web.eenorthcarolina.org/net/content/go.aspx?s=105435.0.0.37430>

 **River Basin Stations, Tatjana Milutinovic, 9th Grade Earth & Environmental Science, Franklinton High School**North Carolina River Basins

Station 1: Discover Your Ecological Address

1. What are the 9 major components of your ecological address?
2. How much of North Carolina's population gets its drinking water from a groundwater source?
3. What is biodiversity?
4. Where are Venus flytraps found in N.C.? Why is this special?
5. What is energy?
6. What are four types of wetlands?
7. How do wetlands provide flood control?
8. What three processes are influenced by topography?
9. What does the quality of air blowing across an area affect?
10. How is exploring your ecological address good for you, not just the environment? (be specific)
11. What is climate?
12. What allows N.C. to have the largest amount of climate variability of a state east of the Mississippi River?
13. What is soil?
14. What is soil made of?
15. How many river basins are in North Carolina? Name three.

Station 2: Discover North Carolina's River Basins

1. What is an estuary?
2. What are the largest and smallest North Carolina river basins?
3. What is a vegetative buffer? How does this influence the health of ecosystems?
4. What did the Clean Water Act of 1972 establish?
5. What is point source pollution? How does this compare to nonpoint source pollution?
6. What is the basic philosophy of the Stream Watch program?

Station 3: Neuse River Basin

1. What is the longest river in North Carolina? At what point is it the widest river in America?
2. Why is the Neuse River important for the fishing and seafood industry?
3. What are two endangered species of mussels?
4. What is the “Carolina mudpuppy”?
5. What is a big threat to water quality in the lower Neuse River?
6. Why did the state stop the creation of new hog farms?
7. By 2020, how many residents are expected in Wake County?

Station 4: Tar-Pamlico River Basin

1. Which part is the freshwater stream? Which part is the brackish water?
2. What is North Carolina’s largest natural lake in the Tar-Pamlico river basin?
3. What freshwater mussel is endemic to Tar River? What does “endemic” mean?
4. What is the state’s largest tobacco-producing county?
5. What are the environmental problems of the Pamlico River?
6. What is the “nutrient-trading” system?

Station 5: North Carolina’s River Basins Poster

1. What shapes a river basin?
2. How is a river compared to an artery?
3. Name the river basins of the following areas: Wake Forest, Louisburg, Hickory, Great Smoky Mountains National Park, and Lumberton.
4. How large is the Amazon River basin?

Various Grade Levels

“As the N.C. Project WET State Coordinator, I distribute hundreds of these publications a year to both formal and nonformal educators. I try to get these valuable environmental educational materials into as many hands as possible because they connect people to the hydrologic cycle in a very personal way. Likewise, educators pass this information onto those they teach, magnifying the resources’ impact.” –Holly Denham

“We have been handing out the River Basin posters to every 8th grade science teacher in our county. I think we've reached about 80% of them so far! They are so interested in the fact that the sub-watersheds in the Wilmington-area now fall in 2 different river basins, whereas they used to be considered to all be in the Cape Fear RB. Thanks!” –Jennifer Butler, Stormwater Education Program Manager, City of Wilmington

“I also teach classes at REI and use these materials with my participants. Wealth of great info for them as well to gain an appreciation for our river basins and water in general. Also what attracts their attention the most in the awesome info on where to hike, paddle and bike in each basin.” –Joy Shuck, US National Whitewater Center



Icebreaker/Review, Joy Shuck, US National Whitewater Center

As a review, I have made two sets of cards from the river basin materials. One set has questions about the river basins and the other set has the answers. I pass all of these cards out to each group and they have to find their match- the appropriate answer that goes with the question (we can also do this in a form of a relay depending on grade level).



Waters of Waccamaw Teacher's Guide, North Carolina Coastal Land Trust

The North Carolina River Basins materials and other resources were used to develop this teacher's guide. The guide includes enrichment activities for courses in History, Science, Math, and Social Studies for eighth grade through high school. The activities are developed in a local context for students to study the natural and cultural environment of the Lake Waccamaw watershed.

This resource is available for download on our website:

<http://web.eenorthcarolina.org/resource/about.aspx?s=105451.0.108.37430>