Modeling The Formation of a River

Grade Level: 6-10

Time: Two class periods. The minimum time required to generate a suitable stream is about three hours. Water that moves too fast tends to create gorges rather than meandering streams. Best results occur if the stream is generated overnight.

Concept: The dynamics of fluvial stream construction and shapes.

Generalization: The processes that form the characteristics that we associate with many large geologic systems can be duplicated in the laboratory on a much smaller scale. One such system is the formation of a river. Using a stream table to duplicate the processes that are at work in the real world, educators can demonstrate how a stream develops the characteristics that we associate with the shape of rivers. Using a minimum of preparation time and inexpensive equipment, a stream table can be constructed that will reveal examples of cut-banks, meandering, terraces, channeling, alluvial fans and deltas.

Objectives: Student will:

1. be able to understand the dynamics of how a stream develops.
2. be able to use the terminology that is associated with the infrastructure of a stream or river.
3. be able to look at a stream or river on a map and be able to identify and discuss the various characteristics that are present.

Materials:

Stream table - See attached directions for building a workable table for less than $100.00.
Water connection for hose.
An area for operating the stream table. A greenhouse or outside is best.
Detailed map showing a river.

Procedure:

Initiating Activity:

Starting at the headwater end of the stream table fill it with wet sand for four or five feet. A general slope of approximately 20 degrees should be constructed at the terminal end of the sand. Wet sand allows you to shape and smooth your contour. Students should observe the stream table set-up. Ask them to write a description of the sand as well as drawing a pre-experimental diagram. (If you have a digital camera and a computer program, sequential pictures of the experiment will document the changes that occur.)

Elevate the stream table to a height of five degrees. Later you may wish to raise the table at various angles to study the effect of slope. Now turn on your source of water. **Remember that the faster the water flows the faster the erosion.** Best results are obtained when the water runs slow and you proceed for at least three hours. The results should mimic the formation of the real thing with the basic exception that water leaks out of the system at the headwaters and this causes some stream channels to dry up and to be abandoned. In the real world rain-water would continue to fill the abandoned channels as well. By the time the experiment has run its course, sand should be distributed the length of the stream table. The terminal end should be fanned to represent a delta.

Analysis:

Several characteristics can appear in your stream. Below are listed a few of the characteristics you should find.

1. Meandering - the snake-like appearance of a stream.
2. Old channels - places where the stream changed course.
3. Cutbanks - high steep banks along the edge of the channel.
4. Terraces - areas running parallel with the stream where water overflowed a channel and created a flood plain.
5. Braided streams - where the stream is broken into many smaller streams.
6. Headwater retreat - this is where the stream floor is cut down (deepened) and is moving toward the headwaters. This is the same as what you would expect from a rapids or a waterfall.
7. Alluvial fan (Delta) - at the terminal end the sand spreads out across the width of the stream table.
8. Lobes - rounded edges of the terminal end where deltas are forming.
9. Active Areas - dynamic areas where water is running out of the alluvial fan as opposed to inactive areas where the fan is static.
10. Ox Bows - This characteristic usually does not form, possibly from the short length of the stream and from channel leaking.

Evaluation:

1. Have the students draw and label the stream at several intervals of formation.
2. They can answer questions about the terminology that is associated with stream characteristics and the process of change. (Examples: Which characteristic appeared first? How did the stream change over time? Did the stream continue to flow in approximately the same area or did it move to the right or the left? What would cause a stream to move?)
3. Give students a map of a large river. Have the students identify places on the map that show stream characteristics that were witnessed from the stream table.

National Geography Standards:

Standard 1: Students know and understand how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

Standard 7: Students know and understand the physical processes that shape the patterns of Earth's surface.

Standard 8: Students know and understand the characteristics and spatial distribution of ecosystems on Earth's surface.

Sunshine State Standards:

SS.B.1.3.2: The student uses mental maps to organize information about people, places and environment.

SS.B.1.4.1: The student uses a variety of maps, geographic technologies including geographic information systems (GIS) and satellite-produced imagery, and other advanced graphic representations to depict geographic problems.

MA.A.3.3.2: The student selects the appropriate operation to solve problems involving addition, subtraction, multiplication, and division of rational numbers, ratios, proportions, and percents, including the approximate application of the algebraic order of operation.

MA.A.3.3.3: The student adds, subtracts, multiplies, and divides whole numbers, decimals, and fractions, including mixed numbers, to solve real-world problems, using appropriate methods of computing, such as mental mathematics, paper and pencil, and calculator.

MA.A.4.3.1: The student uses estimation strategies to predict results, and to check the reasonableness of results.

Resources:

The University of Nebraska at Omaha has a great web site for displaying the results of a stream table experiment. It is found in one of their on-line geology courses taught by Dr. George Maher. The web address is**:** **http://maps.unomaha.edu/Maher/geo101/tablea.html**

Stream tables can also be purchased from Delta Education, 80 Northwest Blvd., P.O. Box 3000, Nashua, NH 03061-3000. The product number is www-110-0373 and the cost is $46.00.

Building a Stream Table

Materials :

4 x 8 sheet of 5/8 exterior grade plywood if it is to be painted. (Marine grade can be used if you decide not to paint it.)

3 eight foot 2 x 4s (Again you can use treated lumber if you do not wish to paint.)

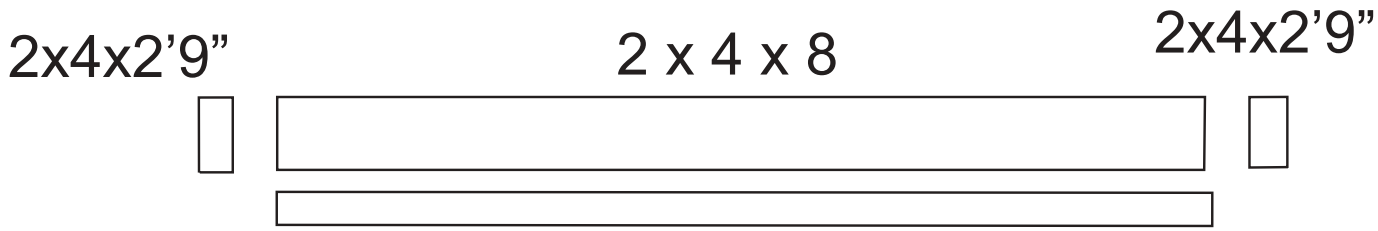
Metal Strapping

3" galvanized sinkers or 2 1/2" deck screws. (When the stream table is moved while containing the sand, it is very heavy.)

Procedure:

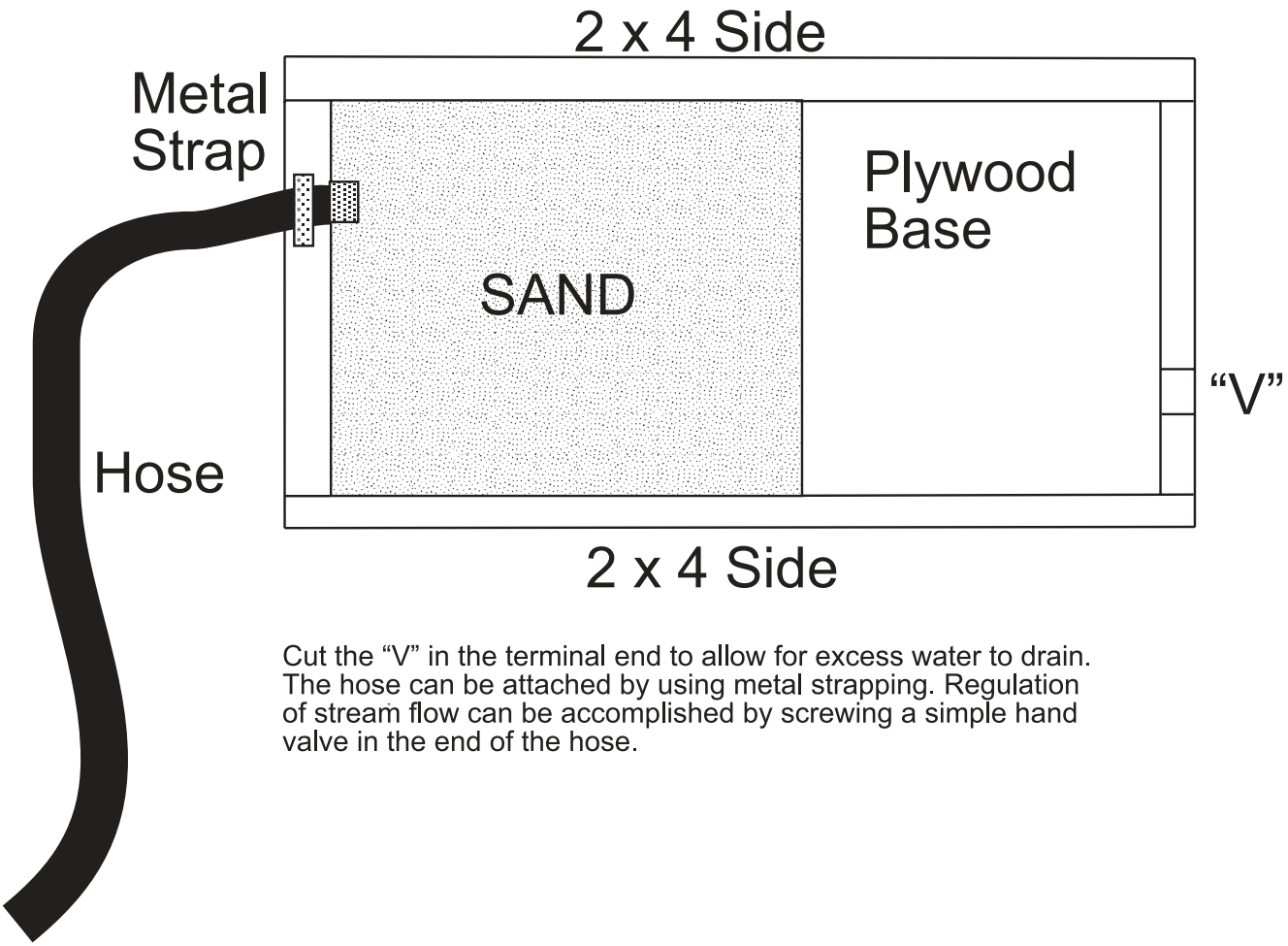
1. Trim the plywood to a width of 3 feet.
2. Two of the 2 x 4s are to be used for the sides of the stream table.
3. Cut the third 2 x 4 so that you have 2 sections for the ends. They should be 2' 9" long as they will sit inside the side walls.
4. On the terminal of the board cut a "**V**" into the wall about 12" from a side. The depth of the "V" should be about 1.5".
5. On the headwater end of the stream table use some type of metal strapping as a place where you will tie your hose into place. The hose must be secure so that it does not move during the experiment.

Constructing a Stream Table



5/8 Marine Plywood Bottom
(3x8)

Use 2 1/2”deck screws to attach the base to the 2x4s. There is a lot of weight on the base when the sand is placed on the table.



Cut the “V” in the terminal end to allow for excess water to drain. The hose can be attached by using metal strapping. Regulation of stream flow can be accomplished by screwing a simple hand valve in the end of the hose.

Cruisin' Down the River

Grade Level: adaptable for all grades

Time: one week

Concept: Anatomy of a River

Objectives: Students will:

1. label the parts of a river.
2. label important rivers on a map of Florida.
3. identify the longest river in Florida.
4. identify the longest rivers in the United States and the world.
5. identify the source, mouth and flow direction of the rivers in Florida.

Materials:

Where the River Begins by Thomas Locker. Puffin Books, 1984. ISBN 0-14-054595-6
Map of Florida rivers transparency and worksheet (located in Blackline Masters section of teacher's guide)
Blank map of Florida transparency and worksheet (located in Blackline Masters section of teacher's guide)
Unlined white 8 ½ x 11 paper
Pencils, crayons, staples
Chart paper, markers
Computer, Internet sites
World Atlas
United States and World Maps
River Information Sheet
River worksheet from National Geographic's Geography Action! website:
(www.nationalgeographic.com/geographyaction)
Florida Rivers 2001 poster

Procedures:

Initiating Activity: Begin the class by asking the students if they can tell you where a river begins. After listening to several responses, explain that two boys asked their grandfather the same question and he took them to see where the river began.

Strategies:

1. Read the book, Where the River Begins, and write down the description of the river as they travel along it on the chart paper.
2. List the following terms on the board: 1) source, 2) mouth, 3) delta, 4) tributary, 5) wetland, 6)meanders, 7) floodplain. Discuss what the terms might mean. Have the students look up the terms and write definitions. Then label the chart of the river descriptions with the terms.
3. Show the transparency of the river worksheet. To get the river worksheet, go to www.nationalgeographic.com/geographyaction and click on the river diagram. This opens a window

that has an option for a diagram with or without labels. The diagram opens in Adobe Acrobat and can be printed. The diagram with labels can also be found on the back of the NGS Geography Action! poster. Based on their definitions, have the students tell you how to label the river. Discuss their reason for their answer.
4. Have them label the River worksheet.
5. Show the transparency of the map of Florida rivers. Discuss where the rivers are located. Are any near your home?
6. Research the rivers in Florida using the Internet sites and the Florida Rivers 2001 poster looking for the longest Florida river.
7. Find the lengths of 5 more rivers in Florida and create a bar graph comparing the lengths of the 6 rivers. Ask extended answer questions about the information found on the student created graphs.
8. Research the longest rivers in the United States and the World. Use the River Information Sheet to fill in on the three rivers.
9. Have students make a flipbook using the information from their River Information Sheet.
10. List the anatomy parts on paper and have the students draw one. Have them create a drawing of the part. Then put together like a puzzle to create a river.
11. Using FCAT-type short response items, extended response items, and performance-based items, answer questions about the book in a guided practice setting to expand their knowledge of the importance of the river.

Culminating Activity: Have the students do a mural including all the parts of the river to display in your classroom or hallway.

Evaluation:

1. Teacher observation
2. Maps
3. Graph
4. River Information Sheets
5. Flipbook
6. FCAT-type reading tasks
7. River worksheet

National Geography Standards:

Standard 1. How to use maps and geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 3. How to analyze the spatial organization of people, places, and environments of earth's surface.
Standard 4. The physical and human characteristics of places.

Sunshine State Standards:

SS.B.1.1.1: determines the absolute and relative location of people, places, and things.
SS.B.1.1.2: uses simple maps, globes, and other three dimensional models to identify and locate places.
SS.B.1.2.1: uses maps, globes, charts, graphs, and geographical tools including map keys and symbols to gather and interpret data and to draw conclusions about physical patterns.
SS.B.1.3.1: uses various map forms and other geographic representation, tools, and technologies to acquire, process, and report geographic information.

LA.A.2.3.5: locates, organizes, and interprets written information for a variety of purposes.
LA.B.1.3.1: organizes information to the type and purpose of writing.
LA.C.1.3: the student uses listening strategies effectively.
LA.C.3.3: the student uses speaking strategies effectively.
SC.G.1.2.5: knows that a model is different from the real thing, but can be used to learn something about the real thing.

Web Sites:

Florida Segments
Jeff Duncan, National park Service
Rivers, Trails, and Conservation Assistance
424 Georgia Ave., Suite 2B
Chattanooga, TN 37403
(423)266-1150
http://ncrc.nps.gov/rtca/nri/FL.html

River Systems of the world
http://www.rev.net/~aloe/river/

Athena Review Image Archive: Rivers Seen from Space
http://www.athenapub.com/rivers1.htm

River and Streams Index
http://www.geography.about.com/cs/riversandstreams/index.htm

River Information

MOUTH: The mouth of the _____River empties into the _____.

LENGTH: The _____ River is _____miles long.

ABSOLUTE LOCATION: The _____River is located at _____and _____.

STATE: A state the _____ River flows through is _____.

COUNTRY A country the _____ River flows through is_____.

CONTINENT: The _____River is located on the continent of _____.

HEMISPHERES: The _____River is located in the _____ and _____.

PLANET: The _____River is located on the planet _____.

GALAXY: The _____River is in the _____Galaxy.

Stream Flow Discharge and Velocity

Grade level: Middle/Secondary

Time: 1-2 Weeks

Concept: Stream flow discharge and velocity

Generalization: Certain factors affect stream flow

Objectives: Students will:

1. be able to make generalizations from a graph
2. be able to measure stream flow velocity

Materials:

Water Atlas of Florida
Seasonal Variation of Stream Flow graphs from Florida Rivers 2001 poster
Relief map of southeastern United States
Climate map of the southeastern United States
Measuring Tape
Rulers/Meter Sticks
Calculators
Observation Chart
Disposable Cameras
Oranges

Background Information:

The season of greatest discharges of rivers in the Panhandle is in the winter, although discharge is certainly significant in other seasons. The explanation for this is that in the watershed of Panhandle Rivers, which extend deep into Georgia and Alabama, there is ample precipitation in the winter. Furthermore, during the winter there is more surface runoff than in the summer, since evaporation is lower (due to lower temperature), and most plants are dormant or nearly so. The rivers must compete with evaporation and plants in the summer. However, they still have substantial discharge even in the warm months, since there is a great deal of rain in the summer.

The farther one goes onto the Peninsula, the longer the dry season. In Florida, this includes fall, winter, and spring. During these seasons, the region is dominated by a high-pressure system that brings great atmospheric stability to the region. Of course, in all years the stability is occasionally broken, some years more frequently than others, by low-pressure systems which come through and bring a great deal of rain. This is especially true when a hurricane or tropical storm arrives. Note that for the three peninsular rivers, September and October are the two months with the greatest discharge. They also are the two months where tropical storms and hurricanes are most frequent.

Two ways stream flow is measured are discharge and runoff. Discharge is the average flow of a river at any particular point and is generally measured in cubic feet or meters per second. To determine discharge it is important to create a cross-section of the river and use a float to determine the speed of

the flow. Runoff is the depth of the water uniformly distributed over a drainage basin. Numerous factors influence runoff and include rainfall amount, how the rain falls (mist to downpour), slope, permeability, geology, and land use. Generally, the flatter the land the more infiltration and less runoff occurs.

Three components to stream flow:

Surface run-off: the water that runs off the surface of the planet
Interflow: water that has percolated through the soil but gets into a stream before it gets into the water table
Baseflow: the contribution of groundwater

A stream is affected by these three components in timely manner. Runoff has the fastest influence on stream flow and the baseflow has the slowest effect on stream flow. Since much of Florida has karst terrain (limestone aquifer system), in times of low flow the groundwater adds to the flow and in times of high flow the terrain may act as a sink by drawing stream flow into the ground.

Flooding in karst is different than in other types of terrain. Since there is less direct runoff it may take weeks for flooding to occur, which does allow ample time for evacuation. The down side to this is that the terrain is slow to drain and floodplain residents may have to wait weeks to return.

Procedures:

Initiating Activity:

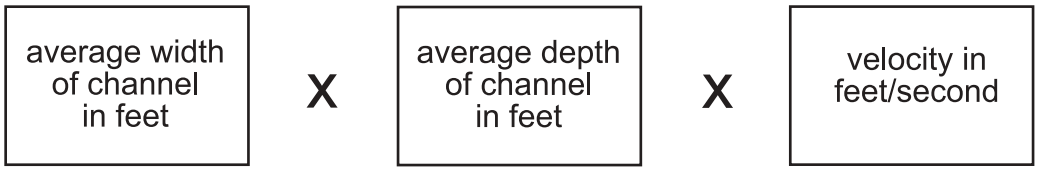
1. Pair students together and give them the graphs of "Seasonal Variation of Stream Flow," a relief map of the southeastern United States and a climate map of the same region.
2. Allow time for the students to compare the maps and then relate it to the information that the graphs provide.

   Questions the teacher may ask:

   a. What patterns do you see?
   b. Is there a season or seasons where you see more rainfall when compared to the other seasons?
   c. Compare and contrast the amount of stream flow discharges with the location of the rivers. Is there a difference between northern, central, and southern Florida?
   d. Are there human/physical factors that you think may hinder stream flow or make it go faster? Explain your answers and provide example.

Strategies: *This part of the lesson is from the Great Lakes Project compiled by Michal Le Vasseur.*

1. Using the following instructions, and placing students in groups of three, have students determine the discharge of a local stream. The stream discharge defines the amount of water that passes a point in a given amount of time. Discharge, expressed as cubic feet/second is calculated as:



17.5 feet wide X 4.0 feet wide X 2.0 feet/second =140 cu ft/sec

2. Carefully measure the depth of the channel with a ruler or meter stick. One measurement should be enough as the stream may be small. Be careful not to disturb any sediment on the bottom of the stream.
3. Carefully measure the width of the channel with a ruler or meter stick.
4. Calculate the velocity:
    a. One person (A) stands by the stream and does not move-if the stream is large and all other measurements have been made you may need to stand in the stream. ***You are the dropper of the orange!***
    b. A second person (B) measures a 10-foot to 100-foot length along the bank by this point. If the stream is large, stand in the stream at this point. ***You are the catcher of the orange!***
    c. A third person (C) is the timer of the orange.
    d. Person A (the dropper) drops the orange in the water and shouts "start" or "drop" or another appropriate remark so that Person C (the timer) can start the timing.
    e. When the orange reaches person B (the catcher) catch the orange and shout "stop" so the timer can stop timing.
    f. Record the time it took for the orange to travel the distance and convert to feet per second for velocity. It is recommended to do this five times and take an average.

Culminating:

Students may photograph each other and the class while engaged in the exercise and then use the photographs in their presentation of recordings to help describe how fast the stream flow was.

Evaluation:

Groups will present their recordings to the class and answer questions that the teacher or other students may have.

National Geography Standards:

Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

Standard 7: The principal processes that shape the patterns of the Earth's surface.

Sunshine State Standards:

MA.D.1.3- the student describes, analyzes, and generalizes a wide variety of patterns, relations, and functions.

MA.D.2.30 the student uses expressions, equations, inequalities, graphs, and formulas to represent and interpret situations.

Web Sites:

Water Resources of Florida
http://fl.water.usgs.gov/

Real-Time Data of Florida
http://water.usgs.gov/fl/nwis/rt

USGS Water Resources of Florida
http://water.usgs.gov/fl/nwis

USGS Home Page
http://www.usgs.gov/

Water Watch
http://water.usgs.gov/waterwatch/

Educational Resources
http://ask.usgs.gov/education.html

Water Resources of Florida-Tallahassee
http://fl.water.usgs.gov/Tallahassee/index.html

Water Resources of Florida-Miami
http://fl.water.usgs.gov/Miami/index.html

How Big and How Much: Comparing Florida's Rivers

Grade Level: upper elementary/middle school

Time: 1-2 class period

Selected Concepts:
Discharge
Runoff
Drainage Basin
Water Management Districts

Objectives: Students will:

1. examine and understand the size of Florida's Rivers on a world scale.
2. recognize the importance of our rivers.
3. understand the importance of managing our rivers.
4. examine the role runoff plays in the health of our fresh water supplies.

Content:
If you look across the St. Johns River as it discharges (water flows out into) to the Atlantic Ocean, you may perceive it to be a large river. If you compare its discharge to the discharge of the major rivers of the world, you realize just how small it is. (see graphic on the poster or blackline masters) Although the rivers in Florida may only have a fraction of the flow of the world's largest rivers, they are very important resources for our human and wildlife populations. The rivers of Florida are vital for transportation, fresh water, irrigation, etc.

Runoff is an important concept to understand when studying rivers. Runoff is calculated by subtracting the amount of water that soaks into the ground, the amount retained in the soil and used by plants, and the amount that evaporates from the total rainfall. Climate, slope, geology, and land use all influence runoff.

Materials:
2001 Rivers Poster (specifically the large Florida map and the two graphics on comparison and runoff)
Blackline master of Comparison
Blackline master of Runoff
Blackline master of blank map of Florida

Procedures:
Initiating Activity: Make an overhead transparency of each of the graphs on Comparison and Runoff in the blackline masters. Show them to the class and ask them to give their opinions about the graphs and make a list of questions they might ask in order to better understand them.

Strategies:
1. Using the river poster map of Florida, have the students discuss the location and size of the rivers mentioned on the graphs.

2. Have students label the blank map of Florida (found in the blackline masters) showing each of the rivers mentioned on the graph. Have students locate, shade and label the major areas of human populations. Then discuss the use of this physical region. Include: recreation, transportation, esthetic activities, and tourism. Include any others the students might suggest. Ask students to examine the Runoff graph and their maps. Pose the question of what would the Northwest need to do differently than the other drainage basins? Which drainage basin has the most human activity? Which one has the most agricultural activity? Which one has the most industrial activity? (Remind them to think about land use and where the populations are found and that different human activities use the rivers in different ways.)

3. Discuss the size of these rivers as compared to the World's largest rivers. Keep in mind that it is important to realize that although the rivers are small on a world scale they are extremely important when it comes to providing fresh water resources and must be protected.

Culminating Activity:
Pose the following question to the students: What is the percentage of cubic feet per seconds (cfs) would the Suwannee River be of the world's largest river, the Amazon? How much does the percentage decrease when looking at the discharge of the St. Johns River? (Students will have to first calculate the percentage for the Suwannee first then the St. Johns and then subtract that amount from the Suwannee percentage to get the percentage decrease.) Then have the students discuss why it is so important to keep a small main river clean than a large discharge river. (Have students think about less water flowing, means less water to dilute the pollutants)

Evaluation:
Student discussion, charts and finally their maps.

National Geography Standards:
Standard 1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 7: The physical processes that shape the patterns of the Earth's surface.
Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface.
Standard 15: How physical systems affect human systems.

Sunshine State Standards:
SS.B.1.3: The student understands the world in spatial terms.
SS.B.2.3: The student understands the interactions of people and the physical environment.

River Through the Ages

Grade Level: 3-6 (can be adapted for higher grades)

Time: one week

Concept: Observation as to how a river changes over time.

Objectives: Students will:

1. compare and contrast how the river changed over time.
2. describe how the change in the area around the river caused the changes in the river.

Materials:

Susan Buckley and Elspeth Leacock. Hands –On Geography. Scholastic,Inc. 1993. ISBN 0-590-49351-5
River Transparencies 1-4
Chart paper, markers, glue, crayons, pencils
Cherry, Lynn. A River Ran Wild. A Gulliver Green Book- Harcourt Brace & Company. 1992. ISBN 0-15-200542-6
Observation Chart
Florida Rivers 2001 poster

Procedures:

Initiating Activity: Ask the students if they think where they live was the same 25, 50, 100 years ago. How would they describe what it might have looked like back then. Discuss what caused the change?

Strategies:

1. Put students in groups of two or three. Each student should have their own paper and pencil.
2. At the top of their paper, each student should make a column for "Human Features" and a column for "Natural Features."
3. Display each of the four transparencies for about 2-5 minutes each, in order.
4. While viewing each of the transparencies, each student should write in the appropriate column what they see.

Example:	Human Features	Natural Features
	farms	trees

5. After viewing all of the transparencies, the group can add up all the features they have seen and put the sum at the bottom of each column. Then discuss what they saw more of and how this changed the characteristics of the river.

Culminating Activity:

Read A River Ran Wild and discuss how the river changed. Compare and contrast with the pictorial river using a Venn-Diagram. (See website for A River Ran Wild below)

Evaluation:

1. Observation
2. Observation Chart

National Geography Standards:
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 4: The physical and human characteristics of places.
Standard 11: The patterns and networks of economic interdependence on Earth's surface.
Standard 12: The processes, patterns, and functions of human settlement.

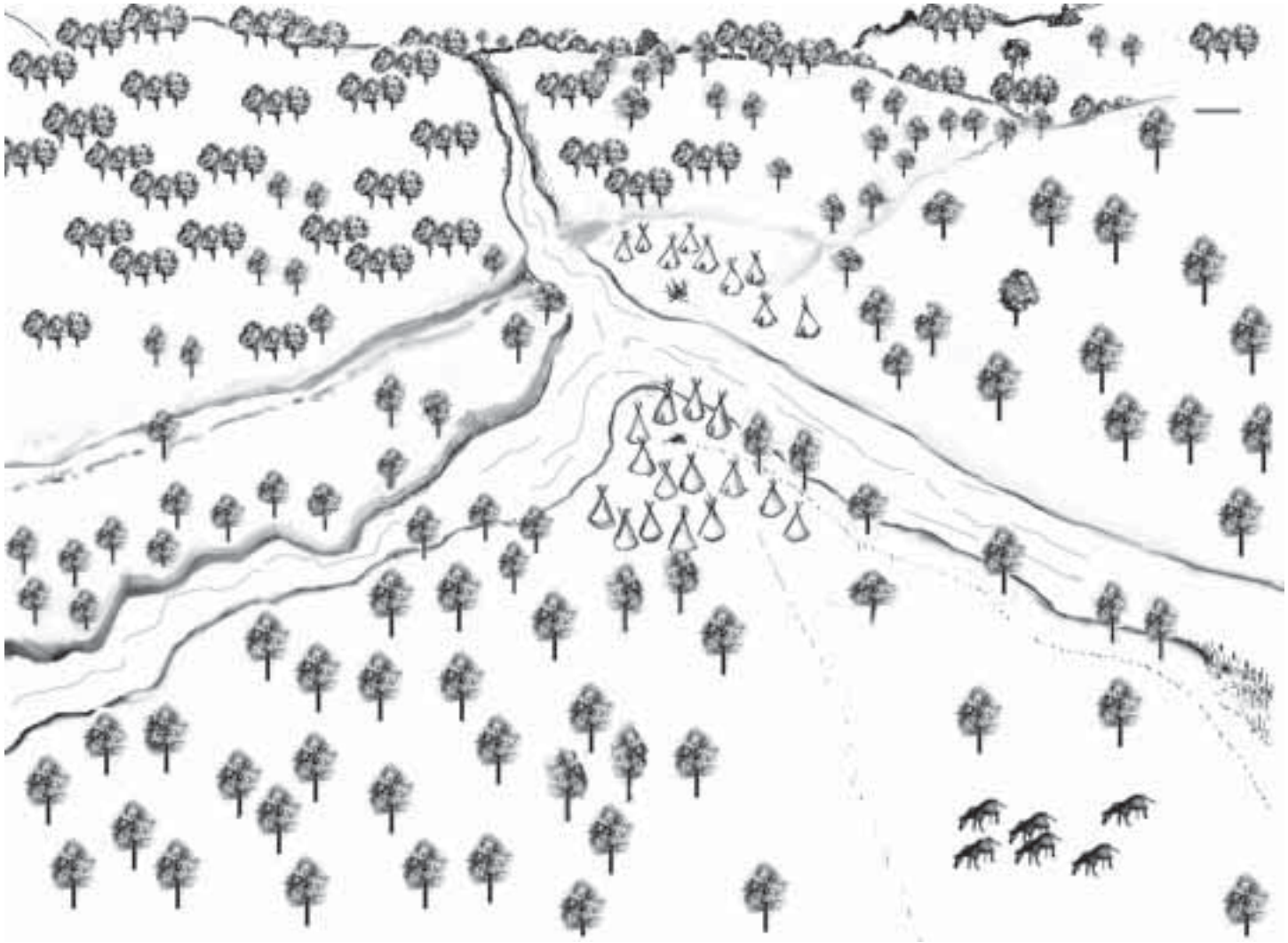
Sunshine State Standards:
SS.A.1.1.1: compares everyday life in different places and times and understands that people, places, and things changes.
SS.A.1.2.1: understands how individuals, ideas, decisions, and events can influence history.
SS.A.2.1.1: identifies some physical and human characteristics of places.
SS.B.2.3.6: understands how the interaction between physical and human systems affects current conditions on Earth.
SS.B.2.3.4: understands how the landscape and society change as a consequence of shifting from a dispersed to a concentrated settlement form.

Web Sites:

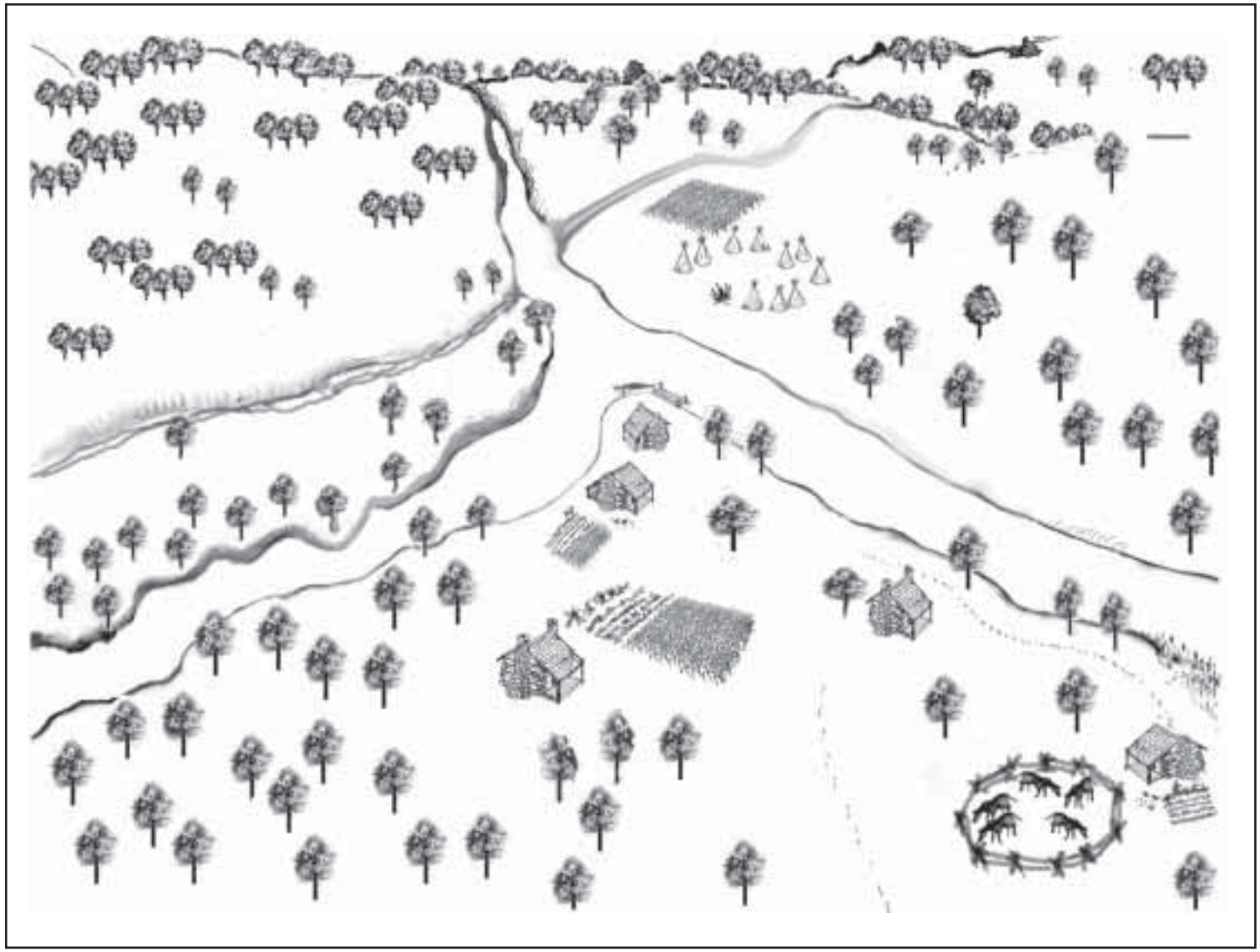
A River Ran Wild

http://www.Sdcoe.k12.ca.us/score/river/rivertg.htm
Lesson plans and activities from San Diego County education website.

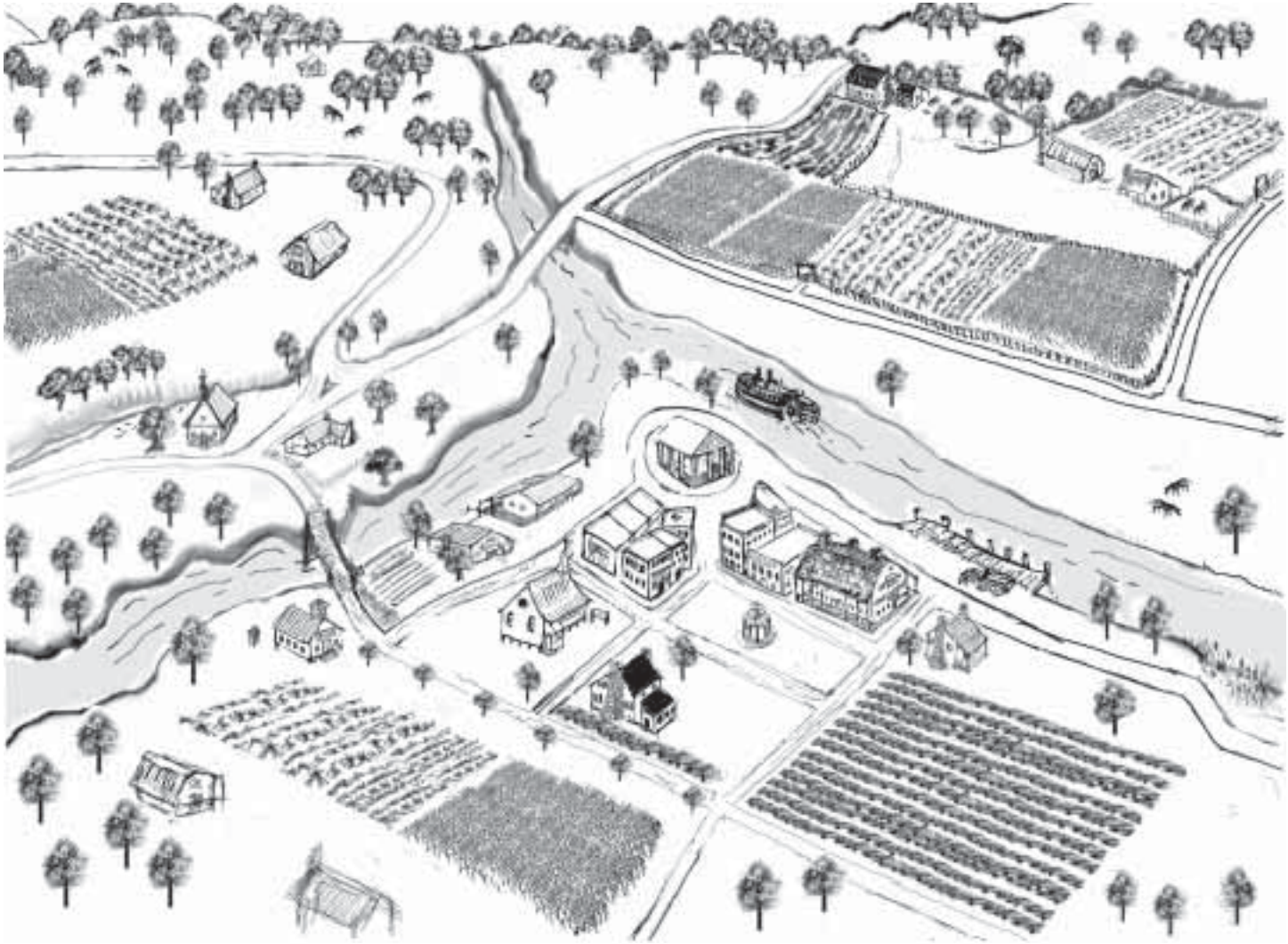
River Transparency 1



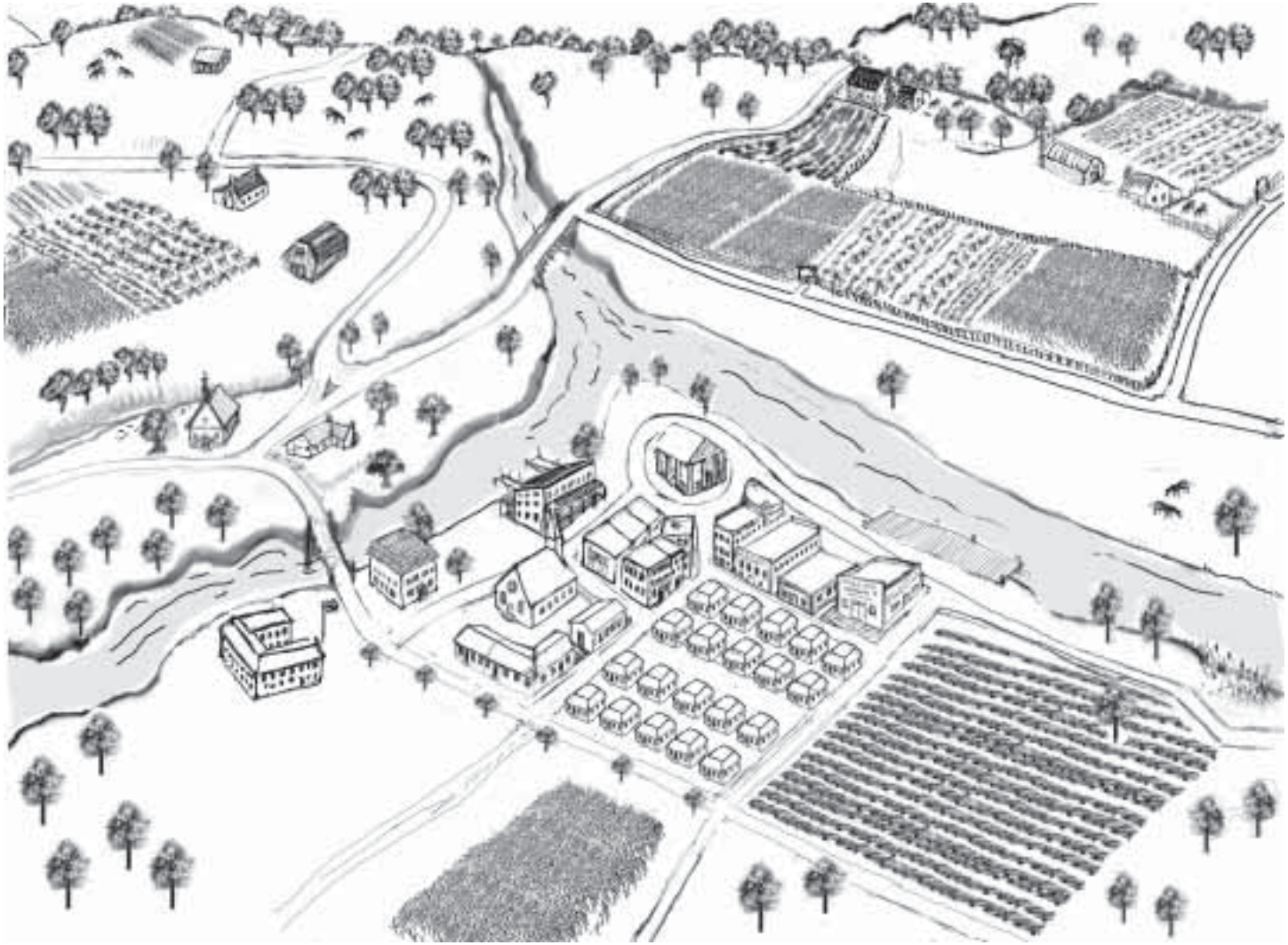
River Transparency 2



River Transparency 3



River Transparency 4



Steamboats Of Florida: Steaming 'Round Florida's Waterways

Grade Level: Middle/Secondary

Time: 2 periods of 45 minutes

Concept: Using maps, primary sources, and background information, students will be able to describe the main reasons for the use of steamboats along Florida's waterways.

Objectives: Students will:

1. use maps to research steamboat routes.
2. use pictures/primary sources to describe steamboat travel.
3. discuss how roads, highways, and airports replaced waterway travel.
4. research and discuss the growth/decline of Florida towns and cities along waterway routes.

Materials:

Florida map of steamboat routes and ports of call.
The Florida Archives Online at http://fpc.dos.state.fl.us
Primary sources such as advertisements, brochures, travel rates and routes, blueprints/plans for a steamboat, and newspaper clippings.

Background Information:

Florida waterways, important to the Native Americans of Florida, were equally important to early American settlers of Florida. In the early 1800's steamboat travel was vital to the transportation of goods, services, and people. At that time, the topography of Florida proved to be too costly and too time consuming to travel through. Steamboats became the means of mobility for tourists, farmers, and tradesmen. Steamboat lines offered the traveler scheduled stops and enough boats to get them where they wanted to go.

Florida steamboats traveled far inland, sometimes provoking a hazardous trip. Steamboats were built of shallow-draft so that they would not drag or scrape the bottom when loaded with cargo. At night, the crew would light baskets of logs to light the way for travel.

Lumber, furniture, farm goods, and people were just several of the items transported by steamboats. Rates of travel depended on what class people wanted to travel. A first class trip from New York to Sanford, Fl cost $27.50, while a person traveling steerage paid $13.50. The early 1900's gave way to railroad travel and eventually the switch was made to highways and airports. Most of the steamboats by then were unused and dismantled for other purposes.

Procedures:

Initiating Activity:

*Note: Prior to this activity, the teacher should research the Florida Archives Online website to download images of early Florida, both land and sea.

1. After the teacher has researched the images and downloaded several for the classroom, the

images should be displayed around the classroom or on the board. A map of Florida, current or old, should also be hanging in the classroom. Ask the students to look over the images and the map and come up with some suggestions as to why steamboats were popular in the early 1800's.

2. Using the steamboat route map, have the students discuss the rivers and cities along the waterways. Are these waterways used today? Why or why not?

Strategies:

1. Using the Florida Archives Online, have pairs of students search for pictures of steamboats. * Note: with each photograph, the Archives provide a title, date, subject heading, and sometimes a brief discussion of the steamer.
2. Have the students describe the pictures and record their thoughts and observations.

Sample Questions for students to use when observing:

a. What time of year is it? How can you tell?
b. Do you think the time of year affected maritime travel? Why or why not?
c. What does the picture reveal about
   Climate?
   Technology?
   Economic Status?
   Occupation?
   Division of labor?
   Travel?
   Trade?
   Goods and people?
d. Why do you think this picture was taken?
e. Did the look of steamboats change over time? If so, describe how they changed.
f. Do you think the picture portrays an accurate picture of Florida at that time?

Culminating Activity:

Pairs of students could give an oral presentation of what they discussed on the images of steamboats, highlighting a photo of choice.

Extension Activity:

Pairs of students could research a Florida city/town from the list provided and discuss the reasons for the growth/decline of the area depending on travel and trade. Graph the use of steamboats, railroads, highways, and airports throughout Florida's history.

<u>List of Florida cities and towns:</u>
Apalachicola
Branford
Cedar Key
Chattahoochee
Fernandina
Jacksonville
Green Cove Springs
Palatka
Silver Springs
Dunnellon

Enterprise
Okahumpka
Sanford
New Smyrna
Titusville
Kissimmee
Tampa
Bradenton
Punta Gorda
Ft. Myers
Jupiter
Miami

Students can take their own pictures of waterways near home and school and research its use and disuse.

National Geography Standards:

Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 4: Physical and human characteristics of places.
Standard 11: The patterns and networks of economic interdependence on Earth's surface.
Standard 17: How to apply geography to interpret the earth.

Sunshine State Standards:

SS.A.6.3.1: understands how immigration and settlement patterns have shaped the history of Florida.
SS. B. 1.3.1: uses various map forms and other geographic representations, tools, and technologies.
SS.B.1.3.7: understands the spatial aspects of communication and transportation systems.

Web Sites:

Florida Archives Online- http://fpc.dos.state.fl.us
http://www.steamboats.org
http://members.tripod.com/~Write4801/riverboats.html

Books:

Images of America Series:

1. Along the St. Johns and Ocklawaha Rivers. Edward A. Mueller, 1999. Arcadia Publishing: Charleston, SC. ISBN 0-7385-0176-x

2. Tampa: The Early Years. Robert J. Kaiser, 1999. ISBN 0-7385-0225-1

Past Connections

Grade Level: 4-8

Time: 2-3 weeks

Concept: Understand the connection between past history and present times

Generalization: Students will learn how rivers and streams have influenced where people settle, choice of occupations, and how early settlers have influenced local communities.

Objectives: Students will:

1. research information using a variety of resources
2. organize information into an outline form
3. orally present a finished product

Materials:

map of your area (current and historical)
resource books from school or public library
list of references about local river history
internet access (optional)
atlases

Procedure: Research articles, books, atlases, and computers with internet access will be available to students for research.

Initiating Activity:

1. Students will decide on a person to research either through their personal family history, text books or through research articles.
2. Students will take notes using note cards.
3. Students will organize information into an outline form.
4. Students will decide how to use their information for a presentation.

Culminating Activity:

1. Students may present the material with technology using HyperStudio or PowerPoint.
2. Students may design a historical poster using visual graphic organizers.
3. Students may write a report using standard research writing style.

Evaluation: Teachers may create a rubric for students to refer to. Teachers can grade note cards, written reports, technology projects. Final overall grade will include a combination of scores from written and oral work, teacher observation and final presentation.

National Geography Standards:

Standard 1: How to use maps and other geographic representations, tools and technologies to acquire, process, and report information from a spatial perspective.

Standard 2: How to use mental maps to organize information about people, places, and environments in a spatial context.
Standard 14: How human actions modify the physical environment.

Sunshine State Standards:
SS.A.2.3.4: understands the impact of geographical factors on the historical development of civilization.
SS. B.1.3.2: uses mental maps to organize information about people, places and environment.
SS. B.1.3.5: knows ways in which the spatial organization of a society changes over time.
SS.A.1.2.2: knows the relative value of primary and secondary sources and uses this information to draw conclusions from historical sources such as data in charts, tables and graphs.
SC.D2.3.2: knows the positive and negative consequences of human action on the Earth's systems.
LA.A.2.3.5: locates, organizes, and interprets written information for a variety of purposes, including classroom research, collaborative decision making and performing a school or real world task
LA.B.2.3.1: writes text, notes, outlines, comments, and observations that demonstrate comprehension of content and experiences from a variety of media.

Resources:
Local Historical Societies
Genealogy Groups
Public Libraries

Web sites:
http://www.dogpile.com
http://www.askjeeves.com
good geography and science search sites

US Geological Survey
http://www.usgs.gov
great posters, info on maps, water monitoring stations data

Florida Department of Environmental Protection (DEP)
Bureau of Aquatic Plant Management
3917 Commonwealth Blvd. MS# 710
Tallahassee, Fl. 32399-3000
http://www.dep.state.fl.us
current environmental issues, park info, water data

Florida Institute of Phosphate Research
1855 W. Main St.
Bartow, Fl. 33830
Telephone: 863-534-7160
http://www.fipr.state.fl.us
excellent educational outreach program, information on all phosphate companies, free materials, speakers, lesson plans available

The Growth of Florida's Canals

Introduction:

This unit of study has two major objectives. One is to look at the spread of canals in south Florida, and the second is to use several geography methods of study including spatial interaction and "diffusion." Spatial interaction analyzes the relationships of cultural and physical phenomenon (in this case found in canals) in space. Diffusion is the movement of a phenomenon over space through time. We are trying to gain a general understanding of the building of canals in southwest Florida, why they were built, when they were built and what they have been used for. We also want to look at the effects the building of these canals has had on the cultural and physical environment. This spatial analysis of canals of South Florida makes this a study in Geography.

Grade Level: upper elementary/middle school

Time: 1-2 class periods

Selected Concepts:
canal
wetlands
Everglades
"River of Grass"
Florida Bay
Land Drawings
Irrigation
Diffusion
Flood Control
South Florida Water Management District

Objectives:

Cognitive:

To understand:

1. what a canal is.
2. various characteristics of South Florida canals.
3. why the canals were built.
4. the spread of canals in Southeast Florida.
5. that this spread of a feature (canals) over the landscape through time is called diffusion.
6. some of the positive impacts of canals on South Florida.
7. some of the negative impacts of canals on South Florida.
8. the efforts of Florida officials to lessen some of the negative impacts of canals on South Florida.
9. the geographic method called spatial interaction.

Psychomotor

Be able to:

1. read a map that shows the spread of canals in South Florida through time.
2. rse a map to show positive impacts of canals on South Florida.
3. rse a map to show negative impacts of canals on South Florida.

4. draw a generalized map of South Florida that shows populated areas, agricultural areas, water conservation areas and the Everglades.

Affective

To appreciate:

1. the character of the undisturbed natural environment of historical South Florida.
2. the historical character of the "River of Grass."
3. the value of applying technology to the natural environment to protect human life.
4. the efforts of the water management agencies in South Florida to balance the needs of people and the natural environment.
5. the use of the geography study method "diffusion."
6. the use of the geography study method "spatial interaction."
7. the difficulties encountered when using mutually exclusive objectives such as: water quality, flood control, multi-use of water, storage, and preservation of wildlife habitat.

Content: (This lesson uses the Florida's Canals Map found in the Blackline Masters. You may want to review this map when reading the following background information.)

- A canal is generally considered to be a man-made waterway or artificially improved river having various uses such as irrigation, shipping, recreation or flood control.
- When Florida became a state in 1845, much of the land, which was low in elevation, was wetland. Wetlands were considered unusable and a barrier to development of highways, railroads, and agriculture. Therefore, one of the first efforts of Florida's early leaders was to drain the land of the water or fill it in so that the land could be used profitably.
- In the 1880's, a Philadelphia businessman by the name of Hamilton Disston bought four million acres of wetland from the state for one million dollars. He began very early to dig canals to drain this land and dig a channel in the Caloosahatchee River and the Kissimmee River basin.
- Napoleon Bonaparte Broward, the governor of Florida in 1904 was elected on the promise to "drain the Everglades."
- Digging channels in the rivers and draining wetlands were called, at that time, "reclaiming land" or, "making land improvements."
- In the early history of Florida all land drainage was done without any consideration of the effects it would have on the physical environment including the modification of groundwater tables, the destruction of wildlife habitat, and the change in salinity at the receiving waters of the Atlantic or the Gulf of Mexico, including Florida Bay.
- About 1920, canals were dug to drain the water at the southern end of Lake Okeechobee and connect the lake with the Caloosahatchee River. As seen on the 1920 map, most of this water was emptied into the Atlantic Ocean.
- By 1930, canals and the channelization of the Caloosahatchee and St. Lucie Rivers allowed the barge transportation of goods between the east and the west coasts. Additional canals were built to provide drainage from Lake Okeechobee, which, by this time had had a five-foot high dike constructed along the southern perimeter of the lake.
- The dike, built during the 1920's at the southern end of the lake, was constructed because several hurricanes had caused flooding which drowned hundreds of people in the Moore Haven and south lake area. Finally in 1928, a very large hurricane with winds from the north blew water out over the southern end of the lake and more than 2,000 people lost their lives. As a consequence of that hurricane, and 85-mile long dike was built, which

over the years has been elevated 34 to 38 feet above the land and more than 20 feet above the mean level of the lake.

- As people moved into the area of southeast Florida during the 1930s canals were widened and deepened for flood control and to create more dry land primarily for agriculture. During the early 1930s a canal was dug as shown on the map from Collier County to Dade County. This allowed the building of the Tamiami Trail, which became the first east-west road between the southern Gulf coast of Florida and the Atlantic coastline.
- The Caloosahatchee, Lake Okeechobee, St. Lucie River barge canal had been deepened and widened through the 1950s and continues to be an important waterway today for both commercial and recreational traffic.
- Several problems became noticeable during the 1950s, which caused people to question whether all the digging of canals had been a wise thing to do. The first problem was the changing of the water flow from Lake Okeechobee south through the Everglades into Florida Bay. This Everglades region needed constant water to supply the grasses that grew there. This area was made famous by Marjorie Stoneman Douglas' book, "River of Grass".
- By the 1960s, what had been called "land improvement or reclamation" was now called by many people "environmental destruction".
- The Everglades was a very wet, grass area, with low mounds called hammocks a few feet above the water table on which much wildlife lived and numerous trees grew. The water moved through the river of grass and filtered into Florida Bay, which provided a nursery and a very rich habitat for marine life.
- By the 1970s the flow of the water into Florida Bay had been so modified (reduced) that much of the marine life that had used that habitat for a nursery began to disappear.
- The decrease in water flow through the Everglades also harmed the environmental health of the 10,000 Islands Coast of Southwest Florida.
- A second negative result of the building of canals was the quick movement of water from the surface of southeast Florida out to the Atlantic Ocean rather than percolating into the groundwater table from which the communities of Dade, Broward, and Palm Beach counties receive their water supply.
- By the 1960s the map shows that there were several lower levies built in Palm Beach, Broward and south into Dade County that kept the water in "conservation areas".
- These conservation areas held the water and allowed it to filter into the shallow aquifer that is so important for domestic supplies along the heavily populated Atlantic coast.
- The canals were maintained through the 1970s as a way of draining the land south and east of Lake Okeechobee to be used for agriculture. This land has been used exceedingly productively as an area to grow sugar cane, green peppers, corn, beans and many other vegetables.
- A major land use argument began over whether the draining of land and the diversion of water was good for society or bad.
- People interested in water resource management and environmental protection battled in the newspapers, meeting and the courts, with people who made their living in agriculture and real estate, "developers".
- Canals today vary in size from a few feet wide and deep to several hundred feet wide and 12-15 feet deep. Some canal sides are dirt and grass while others are covered by concrete.
- In order to try and maintain the positive benefits of the canal while also meeting the needs of the physical and biological environment for water, a very complex series of lateral canals

(those going out from the main canal), dams, and pumping stations were built. Other structural modifications were made to satisfy both the rapidly growing population and to protect the physical and biological environment.

- By the 1990s the effort to satisfy both the cultural and physical needs of south Florida was unsatisfactory, if not unsuccessful.
- By the 1990s millions of dollars were set aside in a very large plan developed by the State of Florida and the Federal Government to redirect much of the water flow through the canals from the Atlantic Ocean into the Everglades Florida Bay ecosystem.
- From the 1950s, one of the best examples of the failure of the diversion of the drainage of the wetlands in south Florida were the fires set by lightning where the dry ground actually burned because it was hydromorphic soil, that is, it was developed under water from decaying vegetation and it was susceptible to buring.
- Some other fires burned for many years due to the fact there was not enough water in the soil to put them out.
- Other problems included the near extinction of several bird species and the creation of problems for the alligator and the Florida panther, as well as the disappearance of much marine life.
- In effect, one of Florida's and the nation's most prized natural features, the Everglades, and Florida Bay had been detrimentally affected by the canal system that diverted water from the wet ecosystems into either the Gulf of Mexico or the Atlantic Ocean.
- Care must be taken not to categorize the interests such as agriculture, transportation, and municipal and industrial development as evil. Many times as people seek out their own objectives they fail to consider the broader affects that changing one part of the environment has on the rest of the environment. These relationships within the environment or the ecosystem are called synergistic affects.
- Today, many interests, conservation, industrial, agricultural, municipal, and others are working together largely with the cooperation and oversight of the South Florida Water Management District to achieve a water plan which is protective and fair to all interests in South Florida.

Materials:
2001 Rivers Poster (specifically the large Florida map showing the canals)
Blackline master of Florida's Canals
Blackline master of blank Florida Map

Procedures:
Initiating Activity: Make an overhead transparency of the Florida Canal Map in the blackline masters. Show the map to the class and ask them to give their opinions about the map and make a list of questions they might ask in order to better understand it.

Strategies:
1. Using the river poster map of Florida, have the students discuss the relative location of Lake Okeechobee, Atlantic Ocean, Gulf of Mexico, the Everglades, the low Atlantic coast ridge of land, the St. Lucie River, the Caloosahatchee River, Florida Bay, and the 10,000 Islands.

2. Have students label the blank map of Florida (found in the blackline masters) showing each of

the features mentioned above. Have the class discuss the positive character of the region including the environmental interconnections of each part.

3. Using the same map, have students locate, shade and label the major areas of human populations. Then discuss the use of this physical region. Include: recreation, transportation, esthetic activities, and tourism. Include any others the students might suggest.

4. Have the students make a chart of these human activities, where they are located and if they think they are environmentally friendly or not. Ask students to share their chart and discuss their opinions.

5. Using the internet or the library, find newspaper articles and government reports that discuss the differing positions of competing economic, business, and environmental groups. (See resources for newspaper sites) Once they have found and read the articles, ask them to review their charts to see if they still feel that the activities they listed are still environmentally friendly or not. If they have changed their mind, have them discuss what helped them make that decision.

Culminating Activity:
Have students write to the South Florida Water Management District Education office (address and phone number are in the attached resources) and request reports, videos, maps, and films related to canals. Then have students prepare a persuasive paper or speech that would be shared with decision makers discussing canals, fresh water and the citizens of Florida. Every school is located within the limits of one of Florida's Water Management Districts and each district has an education office that works with schools. They can provide materials, data and even guest speakers for this activity. Use the following discussion questions to help select a topic for their paper.

1. Why are most of Florida's canals in South Florida rather than North Florida?
2. What is the problem with back-pumping water that has been used on agricultural lands back into Lake Okeechobee or into water conservation areas? Include a discussion of fertilizers, insecticides, and herbicides as pollutants.
3. How is the quality of water important to the Everglades and Florida Bay?

Evaluation:
Students maps, discussion, charts and finally their final speech or paper

National Geography Standards:
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 14: How human actions modify the physical environment.
Standard 15: How physical systems affect human systems.

Sunshine State Standards:
SS.A.6.3: The student understands the history of Florida and its people.
SS.B.1.3: The student understands the world in spatial terms.
SS.B.2.3: The student understands the interaction of people and the physical environment.

Don't Point at Me!

Grade Level: 4- 8

Time: two or three 90 minute classes

Concept: Understand the two major categories of pollution

Generalization: Students will understand the difference between point source and nonpoint source pollution.

Objectives: Students will:

1. define and describe two major categories of pollution: point source and nonpoint source.
2. identify ways to minimize nonpoint source pollution.

Materials:

Magazine photographs
newspaper articles
slides or other pictures of water pollution
worksheet of point and nonpoint sources of pollution (in blackline masters section)
Enviroscape Kit (maybe borrowed or purchased)

Procedure:

Initiating Activity:

1. Do RoundRobin discussion (students take turns talking with their teammates).
2. Teacher will chart student ideas on what causes pollution. What is the cause of pollution in their neighborhood, streams, aquifer, watershed, lakes or rivers?

Strategies:

1. Explain point source and nonpoint source pollution .

Vocabulary:

Point source pollution has a well-defined location, such as the pipe through which factory discharge enters a stream.

Nonpoint source pollution has its source over large areas such as farms, grazing lands, logging roads, construction sites, etc.

2. Reinforce vocabulary using point and nonpoint sources of water pollution worksheet.
3. Review chart.
4. Place students in groups of four.
5. Students will make a T- chart labeled Point Source and Nonpoint Source.
6. Students will decide as a group under which column to place the brainstormed information.
7. Reinforce the vocabulary by having students read newspaper articles, magazines, and picture books to locate and record point source and nonpoint source pollutants.
8. Students will review their sources of pollution and decide ways that their community can minimize this problem.

Reinforcement:

Use the EnviroScape Kit as a hands on reinforcement of the student's understanding for point source and nonpoint source pollutants.

Culminating Activity:

1. Students will write to their local newspapers, city hall or county commissioners about their pollution concerns.
2. Students will invite local officials to a class interview session on pollution concerns. This can be taped for a school wide viewing.
3. Students can design posters depicting pollution vs. non pollution living styles.
4. Brochures on ways to clean up polluted areas in their community can be made and distributed.

Evaluation: Teacher observation, students charts, product assessment

National Geography Standards:

Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a special perspective.

Standard 2: How to use mental maps to organize information about people, places, and environments in a spatial context.

Standard 12: The process, patterns, and functions of human settlement.

Standard 14: How human actions modify the physical environment.

Standard 18: How to apply geography to interpret the present and plan for the future.

Sunshine State Standards:

SS.B.1.3.1: the student uses various map forms and other geographic representations.

SS.B.2.3.6: the student understands the environmental consequences of people changing the physical environment in various world locations.

SS.B. 2.4.5: the student knows how social, cultural, economic and environmental factors contribute to the dynamics nature of regions.

LA.A.1.3 .1: the student uses the reading process effectively.

LA.A.2.3.6: uses a variety of reference materials, including indexes, magazines, newspapers, and journals; and tools, including card catalogs and computer catalogs, to gather information for research topics.

LA.B.2.3.1: the student writes to communicate ideas and information effectively.

SC.D.2.3.2: knows the positive and negative consequences of human action on the Earth's systems.

Resource:

Enviroscape Kit is available on loan through:

1. Water Management Districts Educational Programs
2. Florida Geographic Alliance

Maybe purchased through EnviroScape Headquarters:
14524-F Lee Road
Chantily, Va. 20151
www.enviroscape.com

Websites:
http://www.dogpile.com
http://www.askjeeves.com
good geography and science search sites

US Geological Survey
http://www.usgs.gov
great posters, information on maps, water monitoring stations data

Florida Department of Environmental Protection (DEP)
Bureau of Aquatic Plant Management
3917 Commonwealth Blvd. MS# 710
Tallahassee, Fl. 32399-3000
http://www.dep.state.fl.us
current environmental issues, park information, water data

Florida Institute of Phosphate Research
1855 W. Main St.
Bartow, Fl.33830
Telephone: 863-534-7160
http://www.fipr.state.fl.us
excellent educational outreach program, information on all phosphate companies, free materials, speakers, lesson plans available

River Risin'

Grade Level: 3-6

Time: 1-2 weeks

Concept: Importance and cost of drinkable water

Objectives: Students will:
1. brainstorm pros and cons on making a reservoir.
2. draw a map using legend, compass rose, and scale.
3. role-play the scenario of having a reservoir built where their town is located.
4. write an expository paper on their view of the scenario.
5. research to find other areas around the world where reservoirs have been built.

Materials:
Yolen, Jane. Letting Swift River Go. Little, Brown and Company. 1992. ISBN 0-316-96899-4
Drawing paper
Map of a town
Crayons, colored pencils
Blue Saran Wrap

Background Information:

To provide fresh water for large cities, sometimes it has been necessary for these cities to go other places miles away to find this precious resource. It is sometimes necessary for these large cities to have to make their own supply of fresh water. This was the case in New England when Boston went looking for water. The result of this search was the flooding of the valley of Swift River by damming the river. This created the Quaddin Reservior, one of the largest bodies of freshwater in New England, between 1927 and 1946.

This is not the only place in the world it has happened. During the depression, the Tennessee Valley Authority was created and areas in the South were flooded. Other areas in the world have also had this happen.

Procedures:

Initiating Activity: Ask the students how would they feel if someone came to their house and said they had to move because they were going to flood the area so the big city could get more water for drinking. Discuss their responses.

Strategies:
1. Read Letting Swift River Go. Ask how would they have felt if they had been one of the children in the story.
2. Pick two sides of the classroom and designate one a pro side and one a con side. Have the children pick a side and go stand there. Have one of them give a reason why he/she is on that side. After the reason is given, let them decide to change sides if they would like. Then give another student to express his/her opinion. Observe how the students change or don't change their minds on the topic.

3. Give the students drawing paper to draw a map of a town. The map should include a river. After the map is finished, give student a piece of blue Saran Wrap that is big enough to cover the paper. Attach the paper over the map in order to give it an effect of the town being flooded.
4. Have the students brainstorm the steps Boston went through to create the reservoir. Write an expository paper on how this happened.
5. Have the students write about how they would feel if it would happen in their town. Share the writings.

Culminating Activity:
Research to find other places in the United States and the world where reservoirs have been created. Locate them on a map. Are any near where you live? Discuss what were the results of your research.

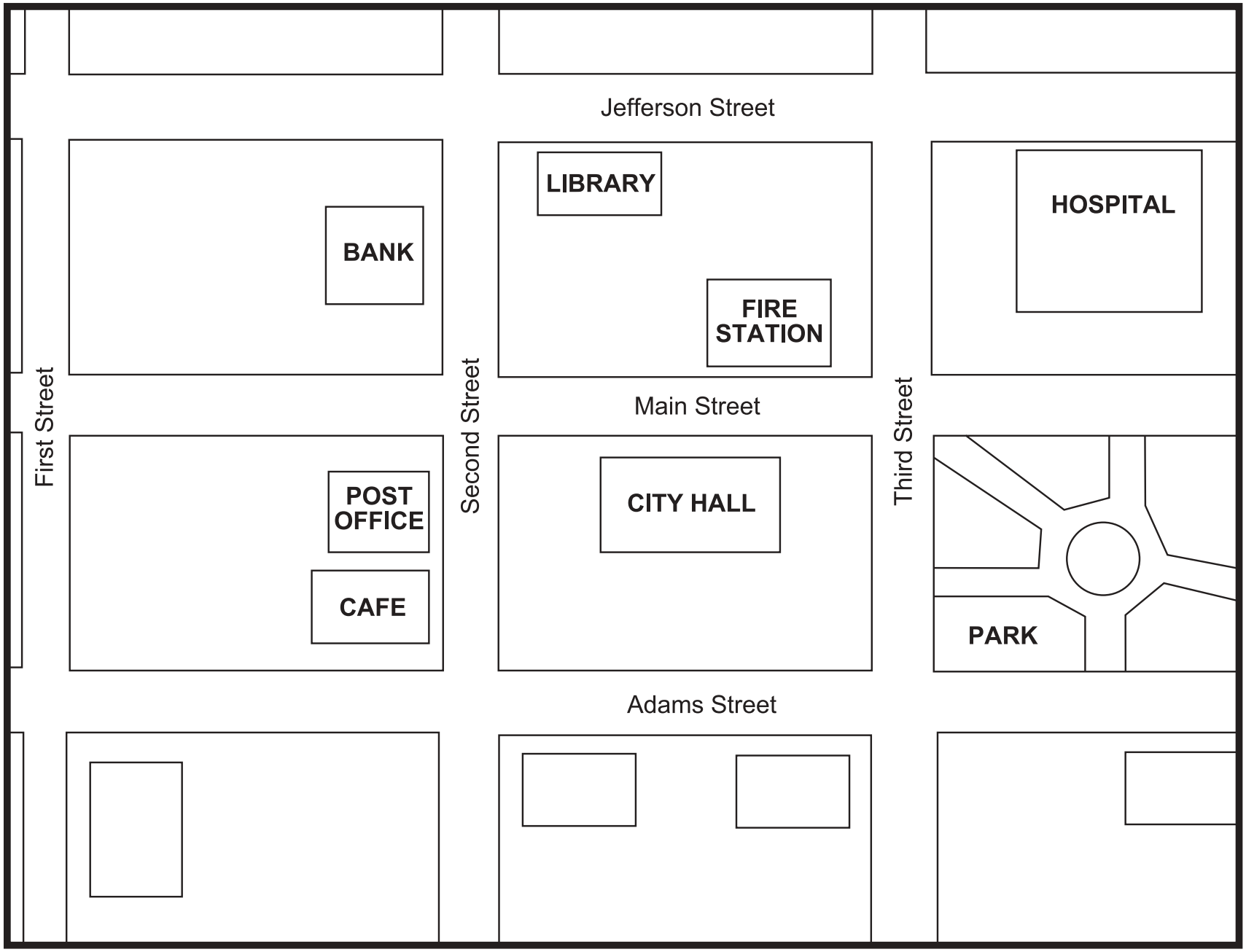
Evaluation:
1. Observation
2. Discussions
3. Map of town
4. Writings
5. Research findings

National Geography Standards:
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface.
Standard 12: The process, patterns, and functions of human settlement.
Standard 13: How the forces of cooperation and conflict among people influence the decision and control of Earth's surface.
Standard 14: How human actions modify the physical environment.
Standard 16: The changes that occur in the meaning, use, distribution, and importance of resources.

Sunshine State Standards:
SS.B.2.1.1: identifies some physical and human characteristics of places.
SS.B.2.3: understands the interactions of people and the physical environment.
SS.B.2.3.6: understands the environmental consequences of people changing the physical environment in various world locations.
LA.B.2.3: the student writes to communicate ideas and information effectively.
LA.B.1.3.1: organizes information to the type and purpose of writing.
LA.A.1.3.3: produces a final edited document.
LA.A.2.3.6: uses a variety of reference materials, including indexes, magazines, newspapers, and journals; and tools, including card catalogs and computer catalogs, to gather information for research topics.
SC.D.2.3.2: knows the positive and negative consequences of human action on the Earth's systems.

SC.G.2.3.1: learning that some resources are renewable and some are nonrenewable.

Town Map


Jefferson Street
BANK
LIBRARY
FIRE STATION
HOSPITAL
First Street
Second Street
Third Street
Main Street
POST OFFICE
CAFE
CITY HALL
PARK
Adams Street

Traveling Down a River

Grade Level: Intermediate/secondary

Time: One to two weeks

Concept: Analyzing the human and physical characteristics along the banks of a river.

Generalization: How the river has changed due to human and physical characteristics.

Objectives: Students will:

1. Describe human features of a river system.
2. Describe natural features of a river system.

Materials:

Classroom set or one copy for the teacher of the book by Vera Williams called *Three Days on a River in a Red Canoe*.
Classroom supply of small notebooks.
Classroom set of disposable cameras.
Pens/pencils
Atlas of Florida
Water Resources Atlas of Florida

Procedures:

Initiating Activity:

1. Ask the class if they have ever traveled on a river by canoe.
2. The teacher should then read the book to the class or pass them to each student for sustained silent reading time. Then discuss the characters, the setting, and what happened along the journey.
    - The teacher, by this time, should have planned a one-day canoe trip for the class.

Strategies:

1. Students should then plan their trip. Supply maps of a local river and have them map a course.
2. Students should choose certain locations and then determine distance between each location and the travel time.
3. The student's final destination site could be for the class picnic.
4. Students should also list that they will need sunscreen, sunglasses, towel, and a change of clothes, tennis shoes, and bug spray.
5. Before traveling, pass out notebooks to each student and then place students into pairs. Explain to the student's that during the canoe trip they are to record in the notebooks the human and natural features they observe while traveling the river. Cameras are also for capturing the human and natural features.

6. Students should also reserve several pages in the notebook for recording features that seem out of place or unusual.

Culminating Activity:

1. After students have returned from their trip have them discuss their findings within their group. During this time, photographs should be developed and returned to the students.
2. Students can discuss about how the river changed and what issues the river may face in the future.
3. Students should also compare and contrast their trip to that of the trip in the book.

Evaluation:

Students will present their photographs and description of the trip to the class.

National Geography Standards:

Standard 14- how human actions modify the physical environment.
Standard 15- how physical systems affect human systems.

Sunshine State Standards:

SS.B.2.3- the student understands the interactions of people and the physical environment.

Title: Alligator Eyes

Grade Level: 3-5

Time: one week

Concept: Observation of life on a back Florida river

Objectives: Students will:

1) Use good listening skills
2) Brainstorm descriptive information
3) Research Florida river life
4) Create a Florida river dictionary
5) Draw a map
6) Create a poem about the habitat of the river

Materials:

Oonawassee Summer by Melissa Forney
Computer, Internet sites
Books on Florida
Guest speakers
Brochures on Florida Rivers from Tourist Information Center
Post Cards showing scenes from Florida Rivers
Chart paper, markers, crayons, construction paper,
Copy of glossary page125 from Oonawassee Summer
Florida Rivers 2001 poster

Background: Oonawassee Summer is a fiction book written about the life on a Florida river. Oonawassee River is a fictitious river with all the "real" life of a Florida river. According to the copyright for the book, Oonawassee Summer" , the publisher, Barker Creek Publishing, Inc., says in their copyright information: "If you are employeed as a school teacher or as an institutional worker, you have the publisher's permission to photocopy the text and illustrations to the extent necessary for use in your classroom to accompany your lessons. Purchase of this book does not entitle reproduction of any part of the book for an entire school, district, or system. Such use is strictly prohibited."

Procedures:

Initiating Activity: Ask the students what would they see if they floated down a Florida river? Make a list of their answers.

Strategies:

1. Read Oonawassee Summer. Discuss and list what is seen and done along the Oonawassee River.
2. Research by book, Florida Rivers 2001 poster or computer life on a Florida river for more background information.

3. Using the alligator as the observer, have the students write what it would be like to be the alligator floating down the river. What would it see, what would it do, and how would it behave?
4. Share the students' stories in oral readings.
5. Show the students the glossary in Oonawassee Summer. Have them create a picture glossary using the things that were seen as they floated down the river in their writing. Publish this in a book.
6. Create a map of the Oonawassee River. Include a legend, compass rose, and a scale.
7. Create a poem on the river habitat

Culminating Activity:
Have the students write the author, Melissa Forney, and describe their understanding of the river life. Also, have students write thank you notes to the speakers who come into speak to the class.

Evaluation:
1. Observation
2. Writings
3. Picture glossary
4. Letter

National Geography Standards:
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
Standard 2: How to use mental maps to organize information about people, places, and environments in a spatial context.
Standard 3: How to analyze the spatial organization of people, places, and environments on Earth's surface.

Sunshine State Standards:
LA.A.1.3: uses the reading process effectively.
LA.B.1.3.1: organizes information before writing according to the type and purpose of writing.
LA.B.1.3.3: produces a final edited document.
LA.B.2.3: writes to communicate ideas and information effectively.
SS.B.2.1.1: identifies some physical and human characteristics of places.
SS.B.2.3: understands the interactions of people and the physical environment.
SC.D.2.3.3: knows the positive and negative consequences of human action on the Earth's systems.
SC.G.2.3.1: learns that some resources are renewable and some are nonrenewable.

Resources:

Forney, Melissa. Oonawassee Summer. Baker Creek Publishing, Inc. 2000.
ISBN: 1-928961-04-5
Speakers on rivers and life on the river. Suggested areas: Florida Freshwater Fish and Wildlife Commission, local state water district, or a parent.

Web Sites:
http://www.dogpile.com
http://www.askjeeves.com
http://www.northernlight.com
http://www.nationalgeographic.com
Florida Segments
http://www.ncrc.nps.gov/rtca/nri/Fl.htm
All Along A River
http://geography.about.com/cs/riversandstreams/index.htm

Examples of Poetry Forms

Acrostic poetry form
Can
Really
Open
Students' minds
Imaginative ways that they
Can present their new knowledge.

I feel the warm humid breeze.
I see the returning of the birds and fish.
I hear the noises of the floodplains.
I taste the fish I now can catch.
I smell the fresh air.
I touch the mud in the restored floodplain.

River
Slow, meandering
Birds, fish, floodplains
KISSIMMEE

Meandering Again!

Grade Level: adaptable for all grades

Time: 1-2 weeks

Concept: Human-Environmental Interaction

Objectives: Students will:
1. describe the historic condition of the Kissimmee River.
2. describe the Kissimmee River Waterway Project in the 1960's.
3. debate pros and cons of the Kissimmee River and floodplain restoration.
4. draw and label a map of the Kissimmee River restoration.
5. create a HyperStudio or PowerPoint presentation to present information.

Materials:
The Kissimmee River article from the Water Resources Atlas of Florida editors: Edward A. Fernald, Elizabeth D. Purdum. University Press of Florida, 1998. ISBN 0-9606708-2-3
The Kissimmee River Restoration Map from the Water Resources Atlas of Florida.
8 ½ x 11 white paper
crayons, pencils, colored pencils,
SFWMD website: Kissimmee River and other websites
Photos of the Kissimmee River
"Song of the Kissimmee"
chart paper, markers
computer, Internet connection

Background Information: Narrow channels and wetlands of the Kissimmee River Basin caused the water to flow slowly towards Lake Okeechobee. During the rainy season, this slowness of the water movement caused the water to back up. This occasionally caused extensive flooding as far north as Orlando. Then in the 1960's Congress authorized the Kissimmee River Waterway Project to help with the flooding. Now, the Kissimmee River Restoration is being done to restore the integrity of the ecosystem and hydrologic conditions that are like a natural river's flow.

Procedures:
Initiating Activity: Ask students if the flow of a river is changed by human intervention, can humans intervene again and restore the flow so that any environmental damage can be corrected?

Strategies:
1. Locate the Kissimmee River on a map of Florida. Discuss the absolute and relative location of it.
2. Read the "Kissimmee River Song". Discuss what the students think it means in relation to what has happened to the Kissimmee River.
3. Read the article on the Kissimmee River. Discuss why it was channelized and why it is being restored.
4. List on chart paper the historical conditions of the river. On another chart paper list the changes

from the channelization, and then on another chart paper list the restoration information. Compare and contrast the charts.

5. Search the web using the sites listed. Find pictures of the Kissimmee River before, during, and after the River Waterway project. Print up a different picture for each student. Have the students write a description of their picture.
6. Have students research the Kissimmee River projects by internet, library and South Florida Water Management District. Using the information they gather and what they have learned in class, have them write an acrostic poem or a feeling poem form to explain what they have learned, illustrate, and share with the class .
7. Role-play the pros and cons of channelizing the Kissimmee River and then restoring the Kissimmee River.
8. Draw a map of the Kissimmee River showing the restoration.

Culminating Activity:

Have students create HyperStudio or PowerPoint presentations to present their information on the Kissimmee River. Include sections on the historical conditions, channelizing, restoration, pros and cons, pictures, and poetry. Present to class.

Evaluation:

1. Observation
2. Writings: description of picture, poetry
3. Map
4. HyperStudio or PowerPoint presentations

National Geography Standards:

Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report geographic information.
Standard 4: The physical and human characteristics of places.
Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface.
Standard 14: How human actions modify the physical environment.
Standard 15: How physical systems affect human systems.
Standard 17: How to apply geography to interpret the past.
Standard 18: How to apply geography to interpret the present and plan for the future.

Sunshine State Standards:

LA.A.1.3: uses the reading process effectively.
LA.A.2.3.5: locates, organizes, and interprets written information for a variety of purposes, including classroom research, collaborative decision making, and performing a school or real-world task.
LA.B.1.3.1: organizes information before writing according to the type and purpose of writing.
LA.B.1.3.2: drafts and revises writing.
LA.B.1.3.3: produces final documents that have been edited.
LA.B.2.3: writes to communicate ideas and information effectively.
LA.C.1.3: uses listening strategies effectively.
LA.C.2.3: uses viewing strategies effectively.
LA.C.3.5: uses speaking strategies effectively.
SC.D.2.3: understands the need for protection of the natural systems on Earth.

SC.D.2.3.2: knows the positive and negative consequences of human action on the Earth's systems.
SS.B.1.1.1: determines the absolute and relative location of people, places, and things.
SS.B.1.3.1: uses various map forms and other geographic representation, tools and technologies to acquire, process, and report geographic information.
SS.B.2.1.1: identifies some physical and human characteristics of places.
SS.B.2.3: understands the interactions of people and the physical environment.
SS.B.2.3.9: understands how the interaction between physical and human systems affects current conditions on Earth.

Web Sites:

Kissimmee River restoration:
www.sfwmd.gov/org/erd/krr/pastpres/3_krrpp.html
http://www.sfwmd.gov/org/erd/krr/events/3_krrce.html
http://www.sfwmd.gov/org/erd/krr/events/3_krrpe.html
http://www.state.fl.us/eog/govdocs/opbenv/saveglades/everglades/ html/kissimee.htm

news articles:
http://www.sfwmd.gov/newsr/2_newsrel.html

These photos were taken on October 24-25, 1996 during a field investigation by U.S. Army Corps of Engineers and South Florida Water Management District personnel involved in the Kissimmee River Restoration Project:
http://www.saj.usace.army.mil/h2o/lib/graphics/kss96oct/

Kissimmee River Restoration:
http://www.eng.fiu.edu/evrglads/engineer/kissimme.htm

Story/Song of the Kissimmee River:
http://riverwoods.ces.fau.edu/kiss/storyk.html
http://riverwoods.ces.fau.edu/kiss/songk.html

demolition photos of the S65B Lock and Dam Structure on the Kissimmee River in June 2000:
http://www.sfwmd.gov/org/erd/krr/photo/s65b/4_s65bpix.html

http://www.google.com
http://www.northernlight.com
http://www.dogpile.com
http://www.askjeeves.com
good geography and science search sites

South Florida Water Management
http://www.sfwmd.gov
student corner, free materials, great environmental information, great pictures of Kissimmee River

Examples Of Poetry Forms

Acrostic poetry form
Can
Really
Open
Students' minds
To
Imaginative ways that they
Can present their new knowledge.

I feel the warm humid breeze.
I see the returning of the birds and fish.
I hear the noises of the floodplains.
I taste the fish I now can catch.
I smell the fresh air.
I touch the mud in the restored floodplain.

River
Slow, meandering
Birds, fish, floodplains
KISSIMMEE

Song of the Kissimmee River

http://riverwoods.ces.fau.edu/kiss/songk.html

The Legend lives on
From the Seminole on down
Of the river they call the
Kissimmee

The river they say
Did meander her way
To big waters they named
Okeechobee

When summer rains arrived
The river would rise
The land was flooded by
water

All nature rejoiced
With a singular voice –
The birds, the fishes and
otters

The white man came
To the land he laid claim
For his cities, his farms and
his ranches

Crops and cattle he grew
But if only he knew
Just how much he was
taking his chances

When the summer floods
Arrived
There were many lost lives
Many dreams were
shattered and broken

The water was viewed
As a force to subdue
Many words about this were
spoken

A plan was applied
To the river and tides
She no longer flowed and
meandered

Life's cycle was changed
It no longer remained
The goddess of nature
seemed angered

Where were the birds?
Songs were no longer heard
Where were the fishes and
otters?

The river was now pooled
Had man been such a fool
To believe he could rule
mother nature?

How can we reverse?
We must open our purse
And pay for mistakes
thought improvements

The scientists were called
Engineers were enrolled
To restore the river's proud
movements

Some day we will find
If we caught it in time
To revive the Kissimmee's
life systems

The earth, it will tell
If we'll only be still
Pay attention to nature and
listen

We must live by her rules
Be wise with our tools
And the world we will leave
to our children

Captain Robert K. Turpin
May 1999

The Kissimmee River

Historical Conditions

The Kissimmee watershed is comprised of areas drained by the Kissimmee chain of lakes and the Kissimmee River valley. Water from the chain of lakes flowed into Lake Kissimmee and out to the Kissimmee River. The river channel was generally 10 feet deep or less and meandered for approximately 103 miles over a 1-to-2 mile wide floodplain to Lake Okeechobee. During wet periods, water overflowed the river banks and covered the floodplain. The surface of the river and floodplain sloped a vertical distance of approximately 36 feet, from 52 feet above sea level at Lake Kissimmee to 16 feet near Lake Okeechobee. The floodplain contained extensive and diverse wetland habitats that supported at least 320 species of fish, birds, mammals, and other animals. Upland vegetation occurred along ridges, islands, and at the floodplain boundary.

Slow movement of water through the narrow channels and wetlands caused water to back up in the rainy season. Occasional but extensive flooding occurred in the river valley, lakes, and watersheds as far north as Orlando. Maximum discharges occurred in October and minimum discharges occurred in May. Water flowed through the Kissimmee valley more than 90 percent of the time – ceasing to flow only during severe droughts. Sediments continually migrated within the basin, forming new channels, ridges, islands, and ponded areas as the river meandered across the floodplain.

Present Conditions

The river channel and channels between lakes were dredged, beginning in the 1880s. When the Central and Southern Florida project was formed in 1947, these channels were further modified to improve flood control and navigation. Regulation schedules were established for the major lakes to provide high water levels for irrigation during the dry season, enough water for navigation, and low lake levels for flood protection during the wet season.

The Kissimmee River Waterway Project was authorized by Congress in the 1960s. A 60-mile long, 33 feet deep, channel (C-38 Canal) was dredged through the floodplain. Water control structures and tieback levees were built to create five impoundments. Floodplain boundaries were still distinct, but 54 square miles of wetlands were lost. With the establishment of regulation schedules in the upper chain of lakes, the valley receives flow from the lakes about 10 percent of the time. Most of this flow occurs within the C-38 Canal. The remaining river channels have no flow and are clogged with silt and vegetation.

At the north end of each impoundment, wetlands are drained and replaced by terrestrial vegetation, farmland, and pasture. At the south end, wetlands are permanently flooded and have changed to ponds or sloughs. Impacts on wildlife were substantial and populations of many desirable species, especially birds and fishes, declined dramatically. Various management methods for impounded wetlands were studied and evaluated during the 1970s and 1980s before it was concluded that the only means to regain lost ecosystem values of the river and floodplain was to restore their physical form and hydrology.

The SFWMD and other agencies have initiated studies to address environmental problems of the Kissimmee system. Water quality and limnological investigations indicate that the productivity of lakes in the Kissimmee chain increased due to the influx of nutrients from adjacent agricultural and urban areas. Many symptoms of eutrophication can be alleviated by controlling the inflow of nutrients from wastewater and stormwater and by periodic drawdowns to consolidate and oxidize accumulated organic materials. Elimination of wastewater discharges and the use of improved farming practices and

upland detention/retention systems to manage flows from tributary watersheds have reduced the influx of nutrients to the Kissimmee lakes and river.

Large-scale efforts are presently underway, by the Army Corps of Engineers, SFWMD, and state agencies to restore the Kissimmee River and floodplain. Success of restoration will be determined by an extensive evaluation program to analyze ecosystem response. Results from this evaluation will be used to determine whether hydrologic and biological attributes have been restored. An adaptive management approach is used so that restoration activities can be modified, in response to data collected, to avoid adverse effects or enhance system performance.

Mathematical models and a physical model of the Kissimmee River were developed during 1986-1989 to simulate flow characteristics of the system, evaluate different backfilling operations, and select the most feasible restoration methods. These models indicated that the restored system could provide adequate water movement during flood periods without causing excessive sediment deposition downstream.

Future Conditions

The area around Orlando is rapidly developing. Urban and agricultural water use are expected to increase significantly during the next 20 years. Restoration activities in the upper basin lakes will add 10,000 acre-feet of seasonal water storage by raising lake levels. This additional water will provide additional flow to simulate historic discharges to the valley. In addition, increased water level fluctuations in the lakes will more closely resemble historic conditions.

Kissimmee River and floodplain restoration involves management of two primary features – form and hydrology – to restore ecosystem integrity. Changes in form are required to restore natural river/floodplain interactions, including connectivity, continuity, and water level recession rates. A 22-mile segment of the channel will be filled, and 43 miles of river and 26,500 acres of floodplain will be restored during the next 10 years. These changes to the form of the river and floodplain will create conditions that are suitable for repopulation by native plant and animal communities, reestablishment of benthic invertebrates, improved distribution of fishes and enhanced use by birds.

The second aspect of restoration is to create hydrologic conditions that simulate the flow of a natural river. Filling of the dredged channel will increase flow and improve oxygen levels in the remaining oxbows. More water will be forced to flow across the floodplain, establish higher water levels, and ultimately support a natural river/floodplain ecosystem.

Finally, ongoing evaluation efforts will be used to demonstrate that observed responses are due to restoration efforts, document that these efforts are fiscally responsible, and determine better ways to manage the system. In addition, the evaluation program provides a basis to justify future construction and funding and to ensure that the people of South Florida receive the benefits they expect.

The Everglades: Finding a Balance

Adapted from a GIS lesson by Kathryn Keranen
GIS version available on the Awareness Week Website for GIS Day!

Grade Level: Secondary

Time: 1-2 class periods

Objectives: Students will:

1. learn a brief history of how the Everglades were formed
2. be able to briefly explain the hydrology of the Everglades
3. be able to interpret a timeline of man's intervention of the Everglades
4. be able to analyze data and graph land use data
5. write a brief summary of their findings

Materials:

Florida Map of the Everglades on the 2001 River Poster
Graph paper
Background information on the Everglades: found in the Water Atlas of Florida (also found on the FGA Geography Action Website under Water Atlas of Florida Background Information or attached abbreviated teacher background provided with this lesson)
Florida Wetland maps for student handouts (need 2 per student: 1 for 1900 and 1 for 1995)

Background Information: (see attached handout)

Procedures:

Initiating Activity:

Put this question on the board or on a transparency before class: What one name is given to "the area of swamps, marshes, sloughs, prairies, tree islands, and forests of southeastern Florida west of the west Atlantic Coastal Ridge"? Answer: Everglades

Ask students if any of them have ever been in the Everglades and what was it like, or what they know about the Everglades if they have never been there. List their responses on the board. Discuss some of the background issues mentioned in the teacher background as the concepts they will be learning in the next activity. There are four things that the students will learn during this lesson. 1) Where are the Everglades?, 2) What is landuse and why is it important to the Everglades past, present and future?, 3) Where have the wetlands gone? and 4) How has landuse changed during the period of time from 1900 to 1995?

Strategies:

1. Using the poster map "Comparison of Historical and Remnant Everglades", ask students to describe what they see on the map and locate this inset map on the larger map of Florida on the poster. Brainstorm possible reasons for the change they see and list these either on the board or in their notebooks. Ask the students to look at the location of the Everglades on the larger map and name the types of man-made structures near or around the Everglades.

2. Talk to the students about the categories of landuse.
   *Remind them that not all landuse activities destroy nature, direct their attention to the state and federal lands protected from development on the map.

   Landuse Categories:
   1=Settled (Urban)
   2=Agriculture
   3=Natural Upland
   4=Natural Wetland
   5=Water
   6=Barren

3. Using the Wetlands 1900 to 1995 map provided and Water Atlas data or the teacher background attached to this lesson, discuss where have all the wetlands gone. Have students use the two maps provided to make this comparison.

4. Using the Data table Percent Change of Landuse 1900-1995; have students graph the data and analyze what they see. Once they have analyzed the graph have them write their own explanation of what they see happening as a writing assignment.

Culminating Activity:

Break students into two groups. Group 1 would be a time traveling group who would go to the past (year 1900) charged with the task to save the Everglades before people began to change the face of the Everglades for human use. Group 2 would be a time traveling group who would go to the future (year 2100) to see what has happened to the Everglades because of the plans made to protect the Everglades today. Each group must come back to the present time and report what they saw as well as write a compelling argument that would convince the political powers of the day that funds provided for Everglades protection are dollars well spent. Reports should use facts, maps and graphics when appropriate and be based on things that could really happen, not complete fantasy.

Extension Activity:

If you have access to a computer lab and ARCVIEW GIS software, go to the Geography Action site lesson plans and find "The Everglades: Finding A Balance" and allow your students to create the maps and graphs needed for analyzing the data used in this lesson. This would be an excellent activity for GIS day during the week!

National Geography Standards:

Standard 1: how to use maps and other geographic representations, tools and technologies to acquire, process, and report information from a spatial perspective.
Standard 4: the physical and human characteristics of places.
Standard 8: the characteristics and spatial distribution of ecosystems on Earth's surface.
Standard 14: how human actions modify the physical environment.
Standard 15: how physical systems affect human systems.
Standard 16: the changes that occur in the meaning, use, distribution, and importance of resources.
Standard 17: how to apply geography to interpret the past.

Standard 18: how to apply geography to interpret the present and plan for the future.

Sunshine State Standards:

SS.B.1: The student understands the world in spatial terms.

SS.B.1.3.1: uses various map forms and other geographic representations, tools, and technologies to acquire, process and report geographic information including patterns of land use.

SS.B.2: The student understands the interaction of people and the physical environment.

SS.B.2.3.2: knows the human and physical characteristics of different places in the world and how these characteristics change over time.

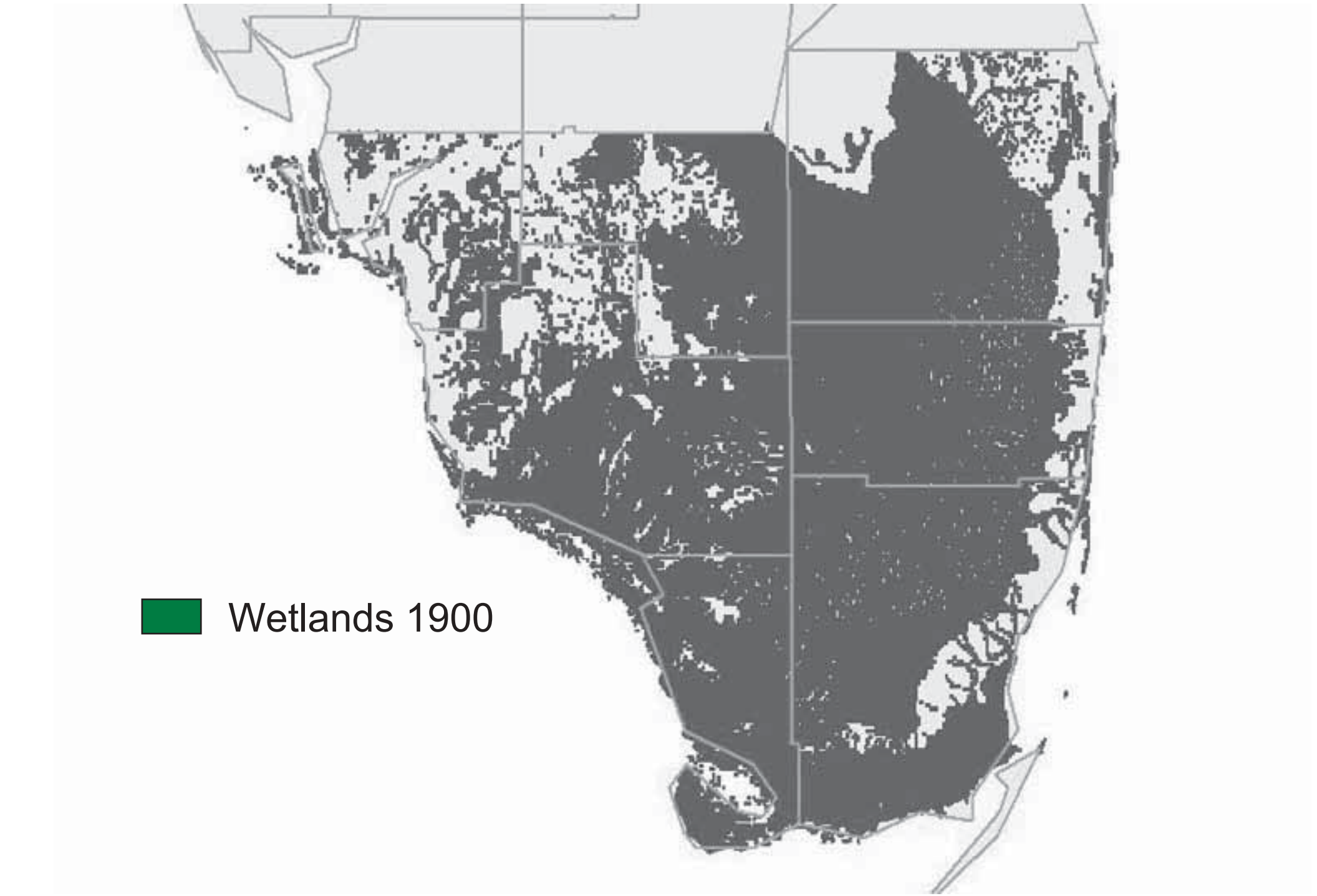
SS.B.2.3.4: understands how the landscape and society change as a consequence of shifting from a dispersed to a concentrated settlement form.

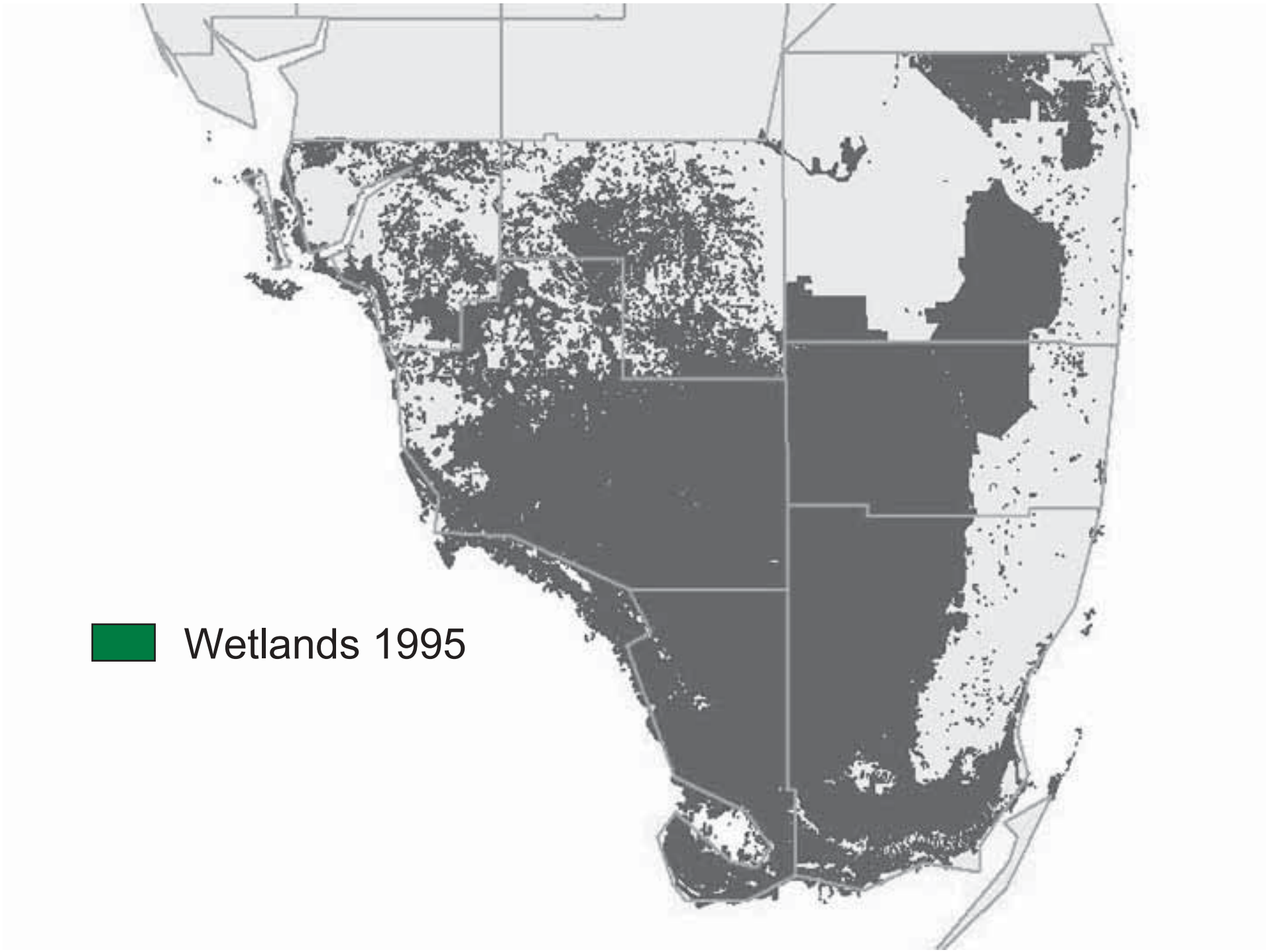
SS.B.2.3.6: understands the environmental consequences of people changing the physical environment in various world locations.

SS.B.2.3.9: understands how the interaction between physical and human systems affects current conditions on Earth.

SS.B.2.4.4: understands the global impacts of human changes in the physical environment.

SS.B.2.4.5: knows how humans overcome "limits to growth" imposed by physical systems.


Wetlands 1900


Wetlands 1995

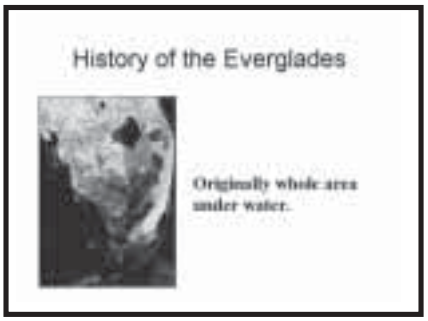
Percent Change of Landuse 1900-1995

LANDUSE	1900	1953	1973	1975	1988	1995
urban	0	2.4	8.5	6.6	13.9	13.2
agriculture	0	7.3	21.7	19.6	21.4	21.9
natural uplands	25	21	14.7	16.8	5.5	7.4
natural wetlands	71.8	65.6	51.5	43.2	49.1	49.9
water	2.7	2.5	2.5	4.4	4.4	6.2
barren	0.12	0.2	0.05	4	0.4	0.6

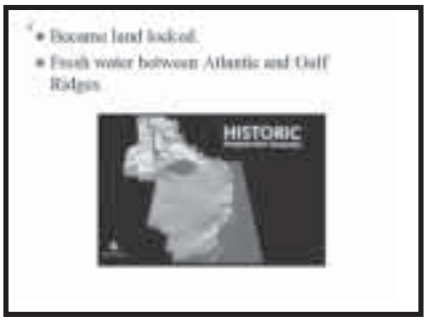
Background Information

1)

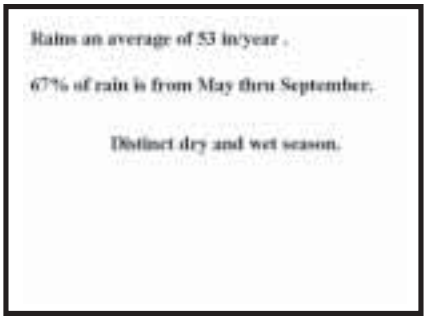
2)



3)

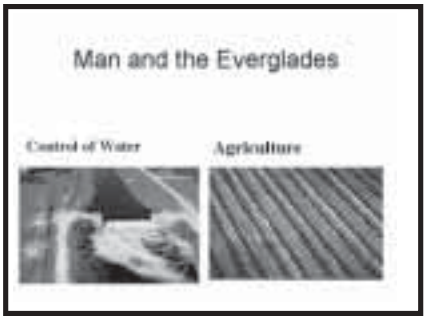


4)

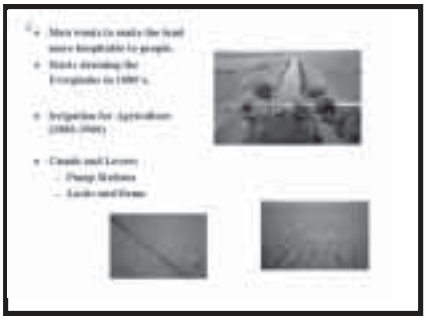


5)

6)



7)



8)

Background Information

9)

Restoration of the Everglades

- National Environmental Protection Act Passed in 1969
  - Damage to environment must be considered in all management decisions
  - Florida's Water Resources Act of 1972 requires control and regulation of water supplies and their use.

10)

- Starting 1980's
  - Trying to control human use of water... developing water management plans.
  - Land acquisition of sensitive areas.
  - Studying long range trends in weather conditions – major droughts on 10 year cycles; major rainfall years on 6 year cycles.
  - Trying to restore parts of Kissimmee River watershed to historical natural conditions.

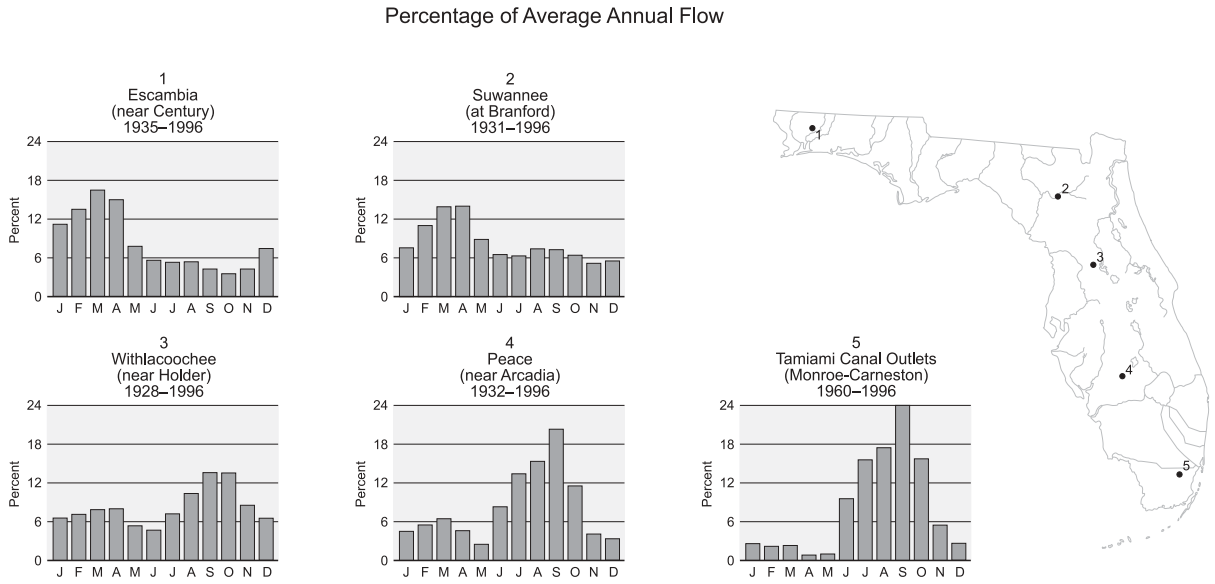
11)

Population and Landuse

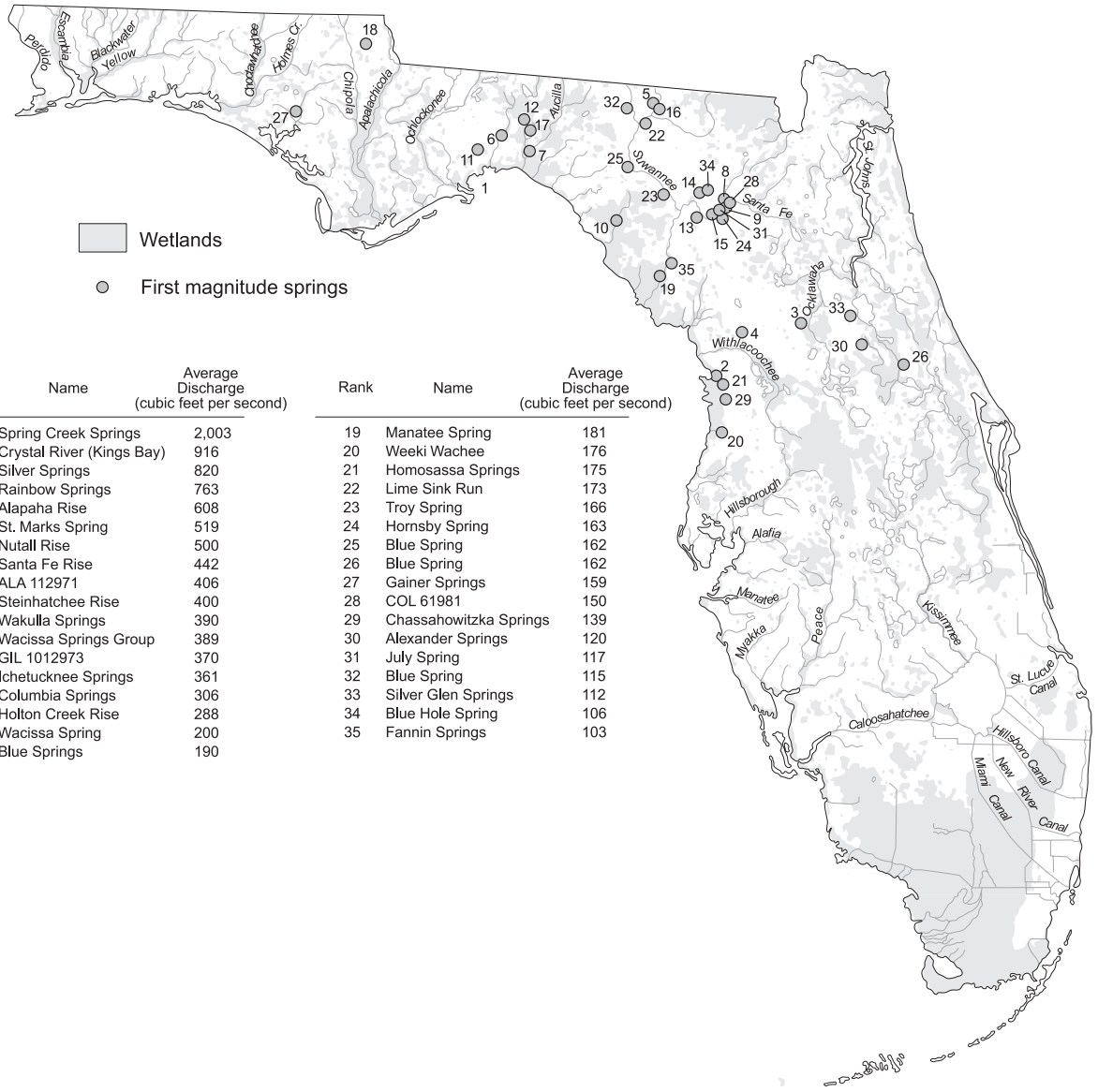
- Population concentrated along East coast; 1/3 of people live in South Florida.
- Agriculture is the major economy and occurs in the center portion of the region. The Everglades Agricultural Area (EAA) south of Lake Okeechobee is one of the most productive farming regions of the country.
- Large portion of south Florida remains natural but disturbed: Kissimmee River floodplain, Lake Okeechobee, Water Conservation Areas 1-3, Big Cypress National Preserve and Everglades National Park.

Poster Blackline Masters

Seasonal Variation of Stream Flow



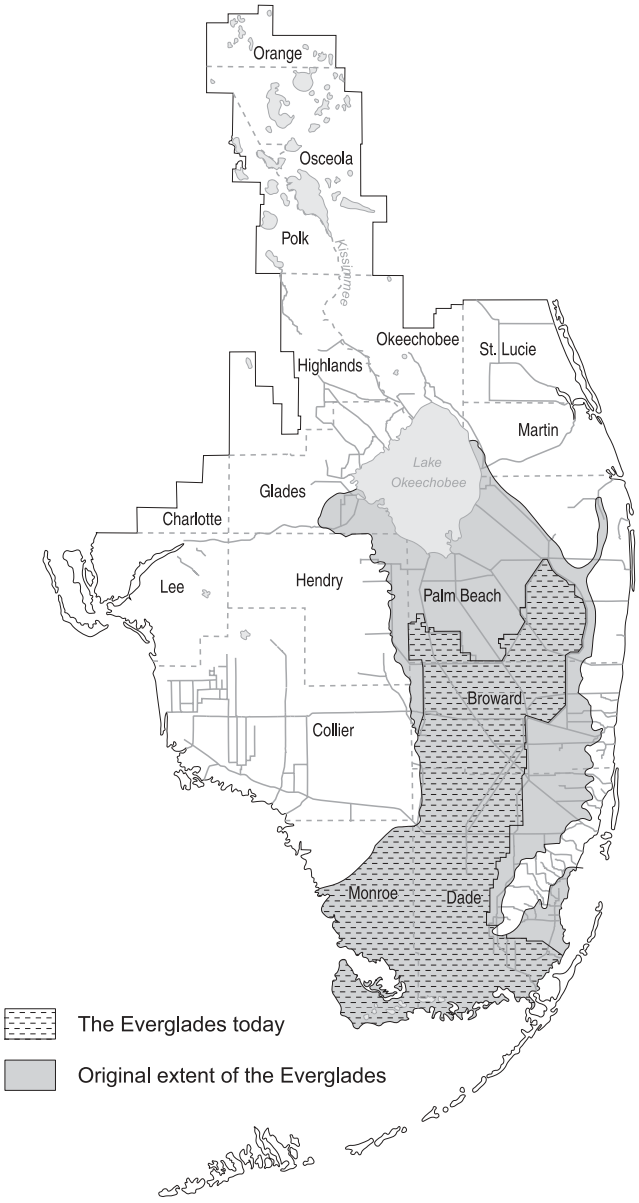
Wetlands and Springs



Rank	Name	Average Discharge (cubic feet per second)
1	Spring Creek Springs	2,003
2	Crystal River (Kings Bay)	916
3	Silver Springs	820
4	Rainbow Springs	763
5	Alapaha Rise	608
6	St. Marks Spring	519
7	Nutall Rise	500
8	Santa Fe Rise	442
9	ALA 112971	406
10	Steinhatchee Rise	400
11	Wakulla Springs	390
12	Wacissa Springs Group	389
13	GIL 1012973	370
14	Ichetucknee Springs	361
15	Columbia Springs	306
16	Holton Creek Rise	288
17	Wacissa Spring	200
18	Blue Springs	190

Rank	Name	Average Discharge (cubic feet per second)
19	Manatee Spring	181
20	Weeki Wachee	176
21	Homosassa Springs	175
22	Lime Sink Run	173
23	Troy Spring	166
24	Hornsby Spring	163
25	Blue Spring	162
26	Blue Spring	162
27	Gainer Springs	159
28	COL 61981	150
29	Chassahowitzka Springs	139
30	Alexander Springs	120
31	July Spring	117
32	Blue Spring	115
33	Silver Glen Springs	112
34	Blue Hole Spring	106
35	Fannin Springs	103

Comparison of Historical and Remnant Everglades



Kissimmee River Restoration

Kissimmee River, prior to channelization, 1961

Kissimmee River, Canal 38

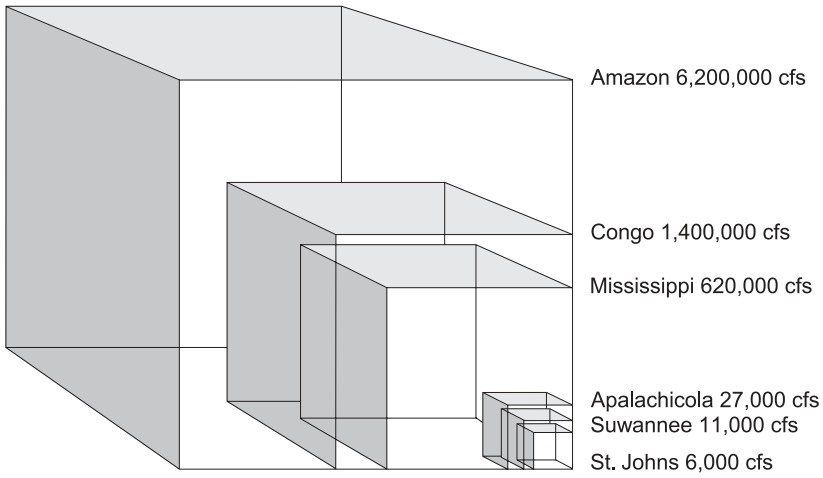
Discharge of Major Florida Rivers

River	Gauging Site (Nearest Town)	Miles Above Mouth	Average Annual Discharge (cfs)	Average Annual Runoff (in.)	Drainage Area Above Site (sq. mi.)
Coastal					
Apalachicola	Blountstown	78	24,768	19.11	17,600
Suwannee	Wilcox	33	10,635	14.98	9,640
Choctawhatchee	Bruce	21	7,198	22.29	4,384
Escambia	Century	52	6,300	22.43	3,817
St. Johns	Deland	142	3,158	14.00	3,066
Ochlockonee	Bloxham	65	1,796	14.36	1,700
Yellow	Milligan	40	1,181	25.68	624
Peace	Arcadia	36	1,170	11.61	1,367
Withlacoochee	Holder	38	1,105	8.22	1,825
Perdido	Barineau Park	27	754	25.99	394
St. Marys	Macclenny	100	683	13.25	700
St. Marks	Newport	14	669	16.96	535
Blackwater	Baker	35	342	22.66	205
Tributary					
Ocklawaha	Conner	51	1,186	13.46	1,196
Alapaha	Jennings	21	1,873	15.14	1,680
Withlacoochee	Pinetta	22	1,672	10.72	2,120
Santa Fe	Fort White	18	1,625	21.79	1,017
Chipola	Altha	54	1,495	25.98	781
Kissimmee	Okeechobee	8	1,409	8.00	2,300
Shoal	Crestview	7	1,104	31.60	474

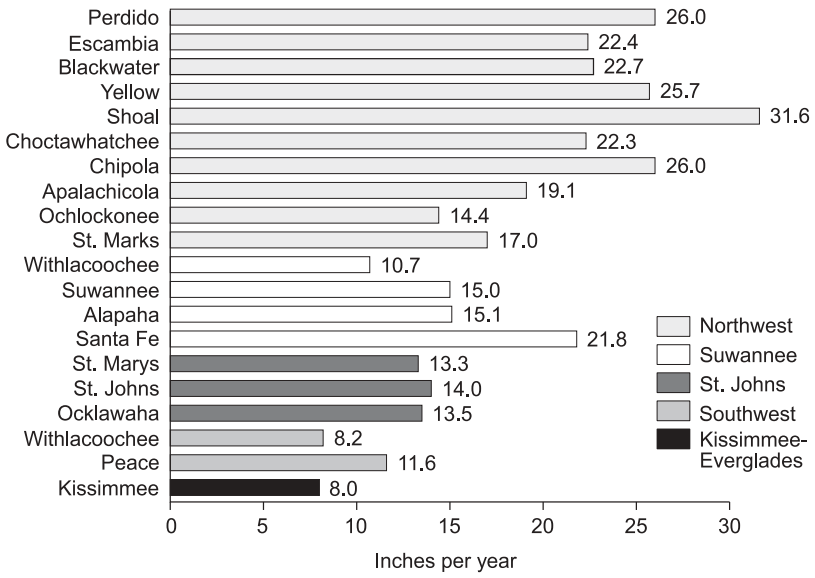
Major Rivers of Florida

River	Region	Length (mi.)	Basin Area ($mi.^2$)	Discharges to
Coastal				
Apalachicola	Northwest	524	19,600	Apalachicola Bay
Suwannee	Suwannee	80	9,950	Gulf of Mexico
St. Johns	St. Johns	273	9,168	Atlantic Ocean
Choctawhatchee	Northwest	230	4,646	Choctawhatchee Bay
Escambia	Northwest	240	4,233	Escambia Bay
Peace	Southwest	133	2,403	Charlotte Harbor
Ochlockonee	Northwest	206	2,250	Ochlockonee Bay
Withlacoochee	Southwest	138	2,035	Withlacoochee Bay
St. Marys	Suwannee	127	1,480	Cumberland Sound
Yellow	Northwest	110	1,365	Blackwater Bay
Perdido	Northwest	68	925	Perdido Bay
St. Marks	Northwest	37	871	Apalachee Bay
Blackwater	Northwest	62	860	Blackwater Bay
Tributary				
Ocklawaha	St. Johns	148	2,718	St. Johns River
Kissimmee	Kissimmee-Everglades	170	2,300	Lake Okeechobee
Withlacoochee	Suwannee	120	2,290	Suwannee River
Alapaha	Suwannee	130	1,840	Suwannee River
Santa Fe	Suwannee	87	1,384	Suwannee River
Chipola	Northwest	115	1,237	Apalachicola River
Shoal	Northwest	50	499	Yellow River

Comparison of Selected Florida Rivers and Major World Rivers



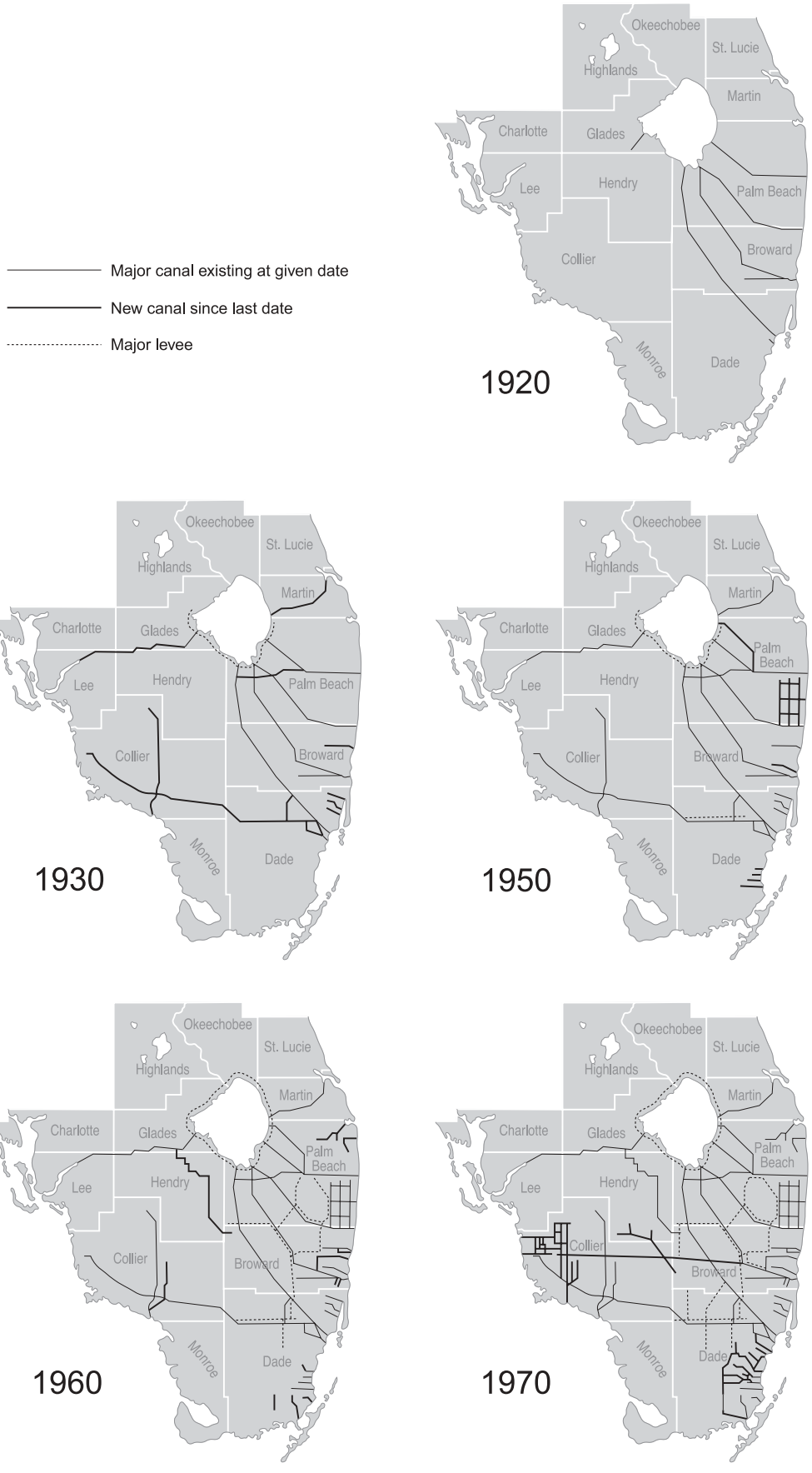
Runoff in the Drainage Basins of Major Florida Rivers



Florida

Florida's Major Rivers

Florida's Canal System



Point and nonpoint sources of water pollution