River on the Rise

Student Guide

Content:

Your Mission

Introduction

Learn all about the **Bronx River** and its watershed.
Take the river's **Water Pressure**.
Set Your Course for exploring watersheds.

Explore the Headwaters

Climb to the **High Points** of the watershed.
Find out about **Buildup** in the system.
Explore the **Vernal Pools** that teem with life.

Swim through the Midstream

Dig Up the Dirt and see what you find.
Do a **Ground Check** to look for runoff.
Let It Rain and watch the water flow.

Dive into the Estuary

Play with the **Life Bubbles**.
Test the Water for pollutants.
Grow Oxygen for the fish.

Culminating

Dive in to your own watershed research.
Write your Watershed Report.

Research Your Watershed

Follow the directions below and write your notes in your field notebook. You will use this information for the culminating activity.

a) Open the regional watershed map and locate yours. Note it down.

b) Open the USGS HUC Catalog and find your watershed. Note down its size and any other important features. You will need this for your final report.

c) Check the Web, your local library and, if you have one, your local historical society. Jot down and two or three interesting facts about the history of your watershed.

d) Find a creature that depends on your watershed for habitat. Explain what part of its life cycle it spends in your watershed and how it uses your land and water. If it faces threats, note those down.

e) Citizen groups, scientists and governmental organizations are active in your watershed. Track them down and jot down what types of work they do and their contact information so you can reach them for your final report.

f) Could litter outside your school wind up in a local body of water? Think about where you school is located in relationship to the nearest body of water. Write a paragraph on a piece of your own paper about the path a piece of litter could take from the front of your school to a local body of water. (Think about storm water and street drains. Do any of those go straight into a local water supply?) Turn your description in to your teacher.

g) See if you can find any large dams or other major civil engineering projects in your watershed. Note their environmental effects if they are affecting wildlife habitat. Turn in two or three paragraphs about what you find out to your teacher.

h) Find out if you have salt marsh restoration project or another kind of planting project in your watershed that is designed to boost DO levels in your watershed.

Work It Out: Introduction

1.1 Check the USGS Consumptive Use and Renewable Water Supply map. How's the water supply holding up for your region?

1. Water Pressure Supply Check

1.2 How many billions of gallons a day are used in your resource region?

1.3 How many billions of gallons of day of renewable water supply is in your region?

2.1 What is the current status of the Tigris-Euphrates conflict? Research it on the Web and turn in two or three paragraphs to your teacher.

2. Water Pressure Monitor Disputes

3. High Points

3.1 At what altitude were the original headwaters of the Bronx River?

3.2 At what altitude is the last dam on the Bronx River?

3.3 What body of water does the Bronx River flow into?

---

4. Buildup Roads

4.1 In what other ways can roads affect wildlife and water bodies?

4.2 Can you think of other types of pollution? How does noise affect animals?

4.3 How can litter cause a forest fire?

5.1 What other sources of pollution could you identify from the activity?

5. Buildup Reservoirs

5.2 Does it make you nervous to have all those things in your drinking water supply?

5.3 What is turbidity? Look it up.

6.1 What is the difference between a frog and a salamander? Use the Internet and write a couple of sentences about their differences.

6. Vernal Pools Bio Hot Spots

6.2 Vernal pools are popular with many other small critters. What do amphibians eat? Could their prey be found in vernal pools?

7.1 How much of the vernal pool envelope is intact in figures A and B?

7.2 How much critical habitat area is left in A and B?

7.3 Which photo-A or B-would you recommend for housing development. Explain your reasons in one or two paragraphs.

Use	Acres	Total Acres	Percentage
Transportation (roads, rail tracks)	1147.6	6637	
Structure (buildings, playgrounds, public monuments)	1200.78		
Public park	1403.45		
Open space (private gardens, zoos, grassy playfields, private woodlands)	1689.56		
Paved sidewalk	353.92		
Paved area	841.69		

8. Ground Check Add Up the Acres

8.1 Working with the chart, find the percentages of the overall watershed belonging to each type of land cover

---

9. Ground Check Surface Labels

9.1 How many total acres of Impermeable Surface are in the survey area?

9.2 How many more acres of Impermeable than Permeable?

9.3 What percent of the watershed is Permeable?

9.4 What percent of the watershed is Impermeable?

10.1 If 8 inches of rain hit a Permeable Surface how much runoff will that cause?

10. Ground Check Follow the Curve

10.2 If 8 inches of rain hit an Impermeable Surface how much runoff will that cause? Need help?

10.3 What is the main lesson of this runoff data?

a. golf courses are permeable
b. impermeable surfaces cause more runoff than permeable spaces
c. the Bronx River watershed has slightly more impermeable than permeable surfaces

---

11.1 Work with the rain-o-meter tool to set up different development scenarios for your watershed. For instance, what if you turned rooftops into permeable space by planting gardens in them? What if you decided to create more open parkland? Or what if you decided to turn parkland into city streets. Create two or three scenarios and then adjust the watershed plan accordingly. Turn on the rain. How are your runoff rates changing?

11. Let It Rain

12. Life Bubbles Vital Signs

12.1 What signs of stress do you observe when DO falls below 5 ppm?

12.2 How do the fish differ in general at higher and lower levels of DO?

---

13. Test the Water Nomograph Know-How

13.1 With the salinity at 10, and the temperature at 10 degrees C, what is the Nomograph reading for DO?

13.2 Leave the salinity reading at 10, but raise the temperature to 15. What happens to the DO? What does the nomograph tell you about the effect of temperature on DO?

13.3 Now set the temperature at 10. This time raise the salinity to 25. What happens to the DO?

13.4 What does the nomograph tell you about the effect of salinity on DO?

	TIME	SALINITY	TEMP	ACTUAL DO LEVEL	SOLUBILITY (from nomograph)	SATURATION PERCENTAGE	Problem for fish?
1	7:30 a.m.	24ppt	21 C	4.15	7.6	55	N
2	9:50 a.m.	22ppt	22 C	6.7			
3	9:54 a.m.	23ppt	22 C	4.23			
4	7:30 a.m.	24ppt	21 C	4.15			
5	8:12 a.m.	24ppt	22 C	3.26			
6	12:35 p.m.	23ppt	20 C	3.66			
7	8:25 a.m.	5ppt	3 C	12.12			
8	10:00 a.m.	3ppt	5 C	12.17			
9	10:15 a.m.	19ppt	5 C	11.35			
10	9:38 a.m.	3ppt	9 C	10.59			
11	9:54 a.m.	14ppt	7 C	9.44			
13	1:15 p.m.	23ppt	15 C	5.72			
12	1:10 p.m.	9ppt	21 C	5.85			
14	11:36 a.m.	25ppt	23 C	5.61			
15	11:49 a.m.	5ppt	24 C	6.1			
16	8:37 a.m.	21ppt	23 C	4.24			
17	8:24 a.m.	26ppt	24 C	3.54			

14.1 How many samplings in all did you analyze (including the example)?

14.2 How many of your readings showed that there was sufficient oxygen for fish?

14.3 How many of your readings indicated that the DO saturation was so low that it might be difficult for fish to get enough oxygen?

14.4 Notice that the sample sets were numbered 1 through 17. Among those, what were the numbers of the sample readings that rang alarm bells for fish?

14.5 What percent of the time did your readings suggest that fish could live in the water? What percent of the time did your readings suggest that the fish would have trouble?

14.6 If rivers with oxygen readings that are at acceptable levels for fish 25% of the time are deemed capable of supporting fish, do your readings show that fish can live in the Bronx River?

Talk Like a Scientist

Science is full of terms. Look through the list and use your biology textbook, the dictionary, and the Internet to define the terms used in this module for which we haven't given you a definition. Make sure to look at the other vocabulary words as well. You may recognize a lot of these words, but scientists might use them in a different context. So check up on your definitions so you can talk like a scientist.

1. **Amphibian**:

Anadromous: migrating from the sea to fresh water to spawn

Benthic: living on or in sea or lake bottoms

Byproducts: Something produced in the making of something else, a secondary result; a side effect

Case-study: A detailed analysis of a person or group, especially as a model of biological, medical, psychiatric, psychological, or social phenomena.

Catadromous: Living in fresh water but migrating to marine waters to breed

Clean Water Act: A federal law, established in 1977, intended to protect the "Waters of the United States" and significant wetlands. It established comprehensive national policies for water quality management.

Consumptive: Consuming or tending to consume, of, relating to, or afflicted with consumption

Desiccation: dryness resulting from the removal of water

2. **Diffusion**:

3. **Ecosystem**:

Endangered: On the verge of extinction

Endangered Species Act: Established in 1973, the purpose of the Endangered Species act is to protect the ecosystems which endangered and threatened species need to survive and to conserve and recover listed species.

4. **Erosion**:

Estuary: The part of the wide lower course of a river where its current is met by the tides.

Flotsam: Floating refuse or debris

Fragment (v): To reduce or become reduced to pieces or components

Gills: The respiratory organ of most aquatic animals that breathe water to obtain oxygen, consisting of a filamentous structure of vascular membranes across which dissolved gases are exchanged.

5. **Habitat**:

Headwaters: The headwaters of a river are small streams that create it.

Herbicides: A chemical substance used to destroy or inhibit the growth of plants, especially weeds

Hibernate: To pass the winter in a dormant or torpid state; to be in an inactive or dormant state or period

Hydro-periods: Period of time during which soils, water bodies and sites are wet

Hydropower: Electricity generated from the energy of running water, usually water falling over a dam

6. **Impermeable**:

Indicator species: A species whose presence, absence, or relative well-being in a given environment is indicative of the health of its ecosystem as a whole

Inversely related: One item affects another so that when one increases the other drops

Larvae: Larvae are the plural of larva: the newly hatched, earliest stage of any of various animals that undergo metamorphosis, differing markedly in form and appearance from the adult

Metamorph: organism that undergoes metamorphosis

7. **Metamorphosis**:

Midstream: the middle part of a stream

Nomograph: a device used to graphically represent complex numerical relations; a graph consisting of three coplanar curves, each graduated for a different variable so that a straight line cutting all three curves intersects the related values of each variable.

Parameters: One of a set of measurable factors, such as temperature and pressure that define a system and determine its behavior and are varied in an experiment.

8. **Permeable**:

Perpetuation: The act of causing something to continue indefinitely; make perpetual

Pesticides: biological, physical, or chemical agent used to kill animals or plants that are harmful to people; in practice, the term pesticide is often applied only to chemical agents

Pollutants: Something that pollutes, especially a waste material that contaminates air, soil, or water

Positively correlated: Two random variables are positively correlated if high values of one are likely to be associated with high values of the other.

Renewable: Relating to or being a commodity or resource, such as solar energy or firewood, that is inexhaustible or replaceable by new growth

Run-off: composed of a mixture of water and soil along with any other organic or inorganic substances that may exist in the land, is the product of precipitation, snowmelt, or other water coming in contact with the earth and carrying matter to streams, rivers, lakes, and other surface water bodies

Salinity: Salinity is the saltiness or dissolved salt content of a body of water

Saturation: The condition of being saturated; full to or beyond satisfaction

Secchi disk: A Secchi disk is an 8-inch (20 cm) disk with alternating black and white quadrants. It is lowered into the water of a lake until it can be no longer seen by the observer. This depth of disappearance, called the Secchi depth, is a measure of the transparency of the water.

Seep: To pass slowly through small openings or pores; ooze; to enter, depart, or become diffused gradually

Septic system: system for onsite disposal and decomposition of solid waste from a home's plumbing waste drains

Solubility: The ability or tendency of one substance to dissolve into another at a given temperature and pressure

Spermatophore: A capsule or compact mass of spermatozoa extruded by the males of certain invertebrates and primitive vertebrates and directly transferred to the reproductive parts of the female

Steward: person who takes part in activities to preserve and improve natural areas such as rivers, woodlands, prairies, etc.

Threatened: On the verge of being endangered

Tributary: A stream that flows into a larger stream or other body of water

Turbidity: Turbidity is a cloudiness or haziness of water (or other liquid) caused by individual particles that are too small to be seen without magnification, thus being much like smoke in air.

9. **Vernal pool**:

Vernal pool envelope: 100 feet of undisturbed land around the edges of a vernal pool needed to provide for amphibian breeding habitat needs.

10. **Watershed**:

Research Guidance

Keep this document with your field notes. After you complete the science-in-action strands, you will choose a final report topic. Already you may have some great ideas. But what form should your report take?
Keep the following possibilities in mind:

Report to a public meeting: Write your report as though you intend to present it at a public forum or to a local watershed citizens' advisory committee. Assume that it will be used by citizens who want to better understand their watersheds and what should be done to protect and restore them.

Advocate for a wild animal's survival rights: Every watershed has a lot of wild animals depending on it for habitat. Show how the species depends on the watershed and the other members of the food web for its survival. Detail habitat threats and, if relevant, threats to the species. Be sure to end with suggestions about how the watershed can be managed to preserve the habitat requirements of your particular species.

Investigate news: Did you find out something new in the course of gathering your field notes? Something about which you can find very little written information? Did you find, for instance, that vernal pools-which you will study in Headwaters--were doing better or worse than anyone realized? Did you discover that dissolved oxygen levels-which you will study in Estuary--are surprisingly low or high? Is runoff-the major topic of Midstream-an untold story near you? Gather your facts, back them up with solid science, and break some news.

Catch trends: Does your topic have something in common with watersheds elsewhere? The Internet lets you spot-check watersheds in Africa, Asia, the Middle East, Europe, South America as well as all around North America. Choose another watershed in another region and compare it to yours.

Feature a project: Did you come across a local watershed restoration project? You might find that you want to write a report on how people in your watershed are working on vernal pools, runoff or dissolved oxygen.

Plan action: Do you see some clear ways that people can work on your chosen topic but are not? Can you develop a big-picture view of how you would like to change your watershed for the better? If you're researching runoff, for instance, you might think your watershed needs an anti-littering campaign or more open space. Devise your own watershed action plan.

Make research understandable: In the course of your research you may have come across some very interesting recent research. You understand it, but you think it might not be easy for others to grasp its significance. Tell the story in a way that people will find interesting. Talk to the authors of the article, if possible, or other scientists who can comment on the research and interpret the findings for a more general audience.

How to Write a Research Report

1. CHOOSE A TOPIC

2. FIND INFORMATION: Keep track of the bibliographical information (title, author, publisher, place and date of publication and page number) of all of your sources of information. Read carefully, taking notes on the main ideas and facts. Write in phrases in your own words.

3. STATE YOUR MAIN IDEA/THESIS STATEMENT: Do some critical thinking and write your thesis statement down in one sentence. Your thesis statement is like a declaration of your belief. The main portion of your essay will consist of arguments to support and defend this belief.

4. MAKE A DRAFT OUTLINE: The purpose of an outline is to help you think through your topic carefully and organize it logically before you start writing. A good outline is the most important step in writing a good paper. Check your outline to make sure that the points covered flow logically from one to the other. Include in your outline an INTRODUCTION, a BODY, and a CONCLUSION.
INTRODUCTION - State your thesis and the purpose of your research paper clearly. What is the chief reason you are writing the paper? Explain briefly the major points you plan to cover in your paper and why readers should be interested in your topic.
BODY - This is where you present your arguments to support your thesis statement. Find three supporting arguments for each position you take. Begin with a strong argument, then use a stronger one, and end with the strongest argument for your final point.
CONCLUSION - Restate your thesis. Summarize your arguments. Explain why you have come to this particular conclusion.

5. ORGANIZE YOUR NOTES: Match your notes to areas in your outline.

6. WRITE YOUR FIRST DRAFT: Leave margins or skip lines for notes and changes and use only one side of the paper.

7. REVISE YOUR OUTLINE AND DRAFT
Read your paper for any content errors. Double-check the facts and figures. Arrange and rearrange ideas to follow your outline. Reorganize your outline if necessary, but always keep the purpose of your paper and your readers in mind.

1. Is my thesis statement concise and clear?
2. Did I follow my outline? Did I miss anything?
3. Are my arguments presented in a logical sequence?
4. Are all sources properly cited to ensure that I am not plagiarizing?
5. Have I proved my thesis with strong supporting arguments?
6. Have I made my intentions and points clear in the essay?

Re-read your paper for grammatical errors. Use a dictionary or a thesaurus as needed. Do a spell check. Correct all errors that you can spot and improve the overall quality of the paper to the best of your ability. Get someone else to read it over. Sometimes a second pair of eyes can see mistakes that you missed.

1. Did I begin each paragraph with a proper topic sentence?
2. Have I supported my arguments with documented proof or examples?
3. Any run-on or unfinished sentences?
4. Any unnecessary or repetitious words?
5. Varying lengths of sentences?
6. Does one paragraph or idea flow smoothly into the next?
7. Any spelling or grammatical errors?
8. Quotes accurate in source, spelling, and punctuation?
9. Are all my citations accurate and in correct format?
10. Did I avoid using contractions? Use "cannot" instead of "can't", "do not" instead of "don't."
11. Did I use third person as much as possible? Avoid using phrases such as "I think", "I guess", "I suppose"
12. Have I made my points clear and interesting but remained objective?
13. Did I leave a sense of completion for my reader(s) at the end of the paper?

8. BIBLIOGRAPHY

Prepare a bibliography and title page