

Reading the Licking River

EDG 693-044  
Summer 2002

A Lesson from the Unit-  
Gaining Understanding of Gunpowder  
(9<sup>th</sup> Grade Honors Integrated Science)

Sara Lainhart  
Conner High School  
Boone County Public Schools  
Boone County, KY

## Data Collection of 4 sites along Gunpowder Creek

Grade Level: 9

**Lesson Context:** Prior to this lesson, the students will have met the following objectives

- In class:
- ☺ Ability to diagram and explain the components of a watershed
  - ☺ Ability to identify pollutants and their origins (or possible origins) Associated with watersheds
  - ☺ Perform pH tests correctly in class using pond water samples and a La Motte pH kit
  - ☺ Perform dissolved oxygen tests correctly in class using pond water Samples and a La Motte dissolved oxygen kit
  - ☺ Ability to use dichotomous keys correctly and effectively
  - ☺ Read a thermometer correctly
  - ☺ Use the Manja method for the detection of fecal coliforms
  - ☺ Collect data in neat table form

The students will have studied topographical maps of the Gunpowder Creek Area. They will have determined the site locations on the maps that we will be visiting. Following that, the students will practice performing the tests using La Motte kits On pond water samples they bring from home. The relevance of the results from the pond water samples will be discussed in the context of ponds. The students will look at plankton, and microscopic creatures in their samples and the macroinvertebrate sampling methods for streams will be introduced. We shall then form our groups and receive the handouts needed for the various assessments. Students will review these in class together with a their partner, practicing using a snapshot. The permission forms will have been secured and the bus booked. A representative from the Extension Office will have come to speak to the class using the enviroscape; and the class will have successfully completed the Color Me A Watershed and a modified version of Sum of the Parts from Project Wet.

With this premise, the lesson for today may begin.

**Objectives: The students will be able to do the following at the 4 sites on Gunpowder Creek:**

- ☺ Perform bacteriological analysis for fecal coliforms using Manja
- ☺ Perform a macroinvertebrate sample on a site of Gunpowder Creek Using a net and a dichotomous key of macroinverts
- ☺ Utilize pH and Dissolved Oxygen La Motte kits properly
- ☺ Obtain temperature readings using a thermometer properly
- ☺ Complete a Biological Monitoring Assessment Report, obtaining a cumulative Index for each site
- ☺ Perform a Habitat Assessment field Data sheet, obtaining a habitat score
- ☺ Perform a Physical Characteristics Analysis and complete the respective data sheet

**Following the site visits, the students will be able to do the following in class:**

- ☺ Create a table to display the data from the four sites
- ☺ Analyze the results from the four sites and discuss reasons for the results obtained
- ☺ Check with local officials and newspapers for recent spills, leaks, or other possible reasons for abnormal readings
- ☺ Submit data to the local Boone County Extension Office and to the offices in Frankfort

**Program of Studies:**

Conceptual Understandings

- The interdependence of organisms
- Geochemical Cycles

Scientific Inquiry

- Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications
- Review and analyze scientific investigations and explanations of other investigators including peers

Applications/Connections

- Explore the impact of scientific knowledge and discoveries on personal and community health....investigate how science can be used to solve environmental quality problems...

**Core Content:**

SC-H-2.2.1 Earth is a system containing essentially a fixed amount of each stable Chemical atom or element. Each element can exist in several Different reservoirs. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of geochemical cycles.

SC-H-3.5.1 Atoms and molecules cycle among the living and nonliving Components of the biosphere.

SC-H-3.5.3 Organisms both cooperate and compete in ecosystems. Often Changes in one component of an ecosystem will have effects on the Entire system that are difficult to predict. The interrelationships and Interdependencies of these organisms may generate ecosystems that Are stable for hundreds or thousands of years.

SC-H-3.5.5 Human beings live within the world's ecosystems. Human Activities can deliberately or inadvertently alter the dynamics in Ecosystems. These activities can threaten current and future global Stability, and if not addressed, ecosystems can be irreversibly affected.

**Materials:**

- \*\* List of the groups and assessments for each of the 4 sites  
(1 per student; 1 per chaperone; total of 30)
- \*\* Macroinvertebrate Dichotomous Key Sheet  
(1 per student, 1 per chaperone; total of 30)
- \*\* Biological Monitoring Assessment Report  
(1 per student, 1 per chaperone; total of 30)
- \*\* Habitat Assessment Field Data Sheet  
(1 per student, 1 per chaperone; total of 30)
- \*\* Physical Characterization/Water Quality Field Data Sheet
- \*\* 2 pH La Motte kits
- \*\* 2 Dissolved Oxygen La Motte kits
- \*\* 4 Macroinvertebrate collection nets
- \*\* 8 Manja tubes
- \*\* Plastic Ziploc baggies (1 box of 50 – sandwich size)
- \*\* 2 thermometers
- \*\* 1 smiling, happy, excited chaperone☺
- \*\* 1 nifty school bus, complete with bus driver, who is also a teacher☺
- \*\* 28 students armed with extra shoes and a plastic bag for wet ones
- \*\* 1 smiley teacher (also w/ extra shoes and a plastic bag for wet ones)
- \*\* Extra pencils and graph paper
- \*\* Coolers for the packed lunches and drinks

**Procedure:**

- 1) Students will be called to the office and will board the bus after their forms have been checked around 9 AM.
- 2) Students will sit with their partner and review the information for the first site while the teacher finishes loading the supplies onto the bus.
- 3) After checking the route with the driver, the bus will depart for the first site, closest to the origin of the creek (Site 1 off Limaburg Road, about 1 mile S of the Airport).
- 4) While en route, students will be reminded of assessment etiquette and procedural rules.
- 5) Upon the arrival at the site 1, students will disembark, collect the necessary equipment for their 1<sup>st</sup> reading, perform it, replace the equipment, gather equipment for second reading, return equipment, make observations, load up the bus, and depart.
- 6) On the bus to the next site, data will be shared and recorded by the various groups.
- 7) Upon arrival at site 2 (located off Camp Ernst Road near the horse stables, about 500 feet from a pump station) students will follow the same procedure as outlined in #5 (see above).
- 8) Same procedure as #6 (see above).
- 9) Upon arrival at site 3 (located off Dale Williamson Road next to the Smith's Bridge) students will follow the same procedure as outlined in #5 (see above).

- 10) Students can sit on the bridge and eat their lunches, clean up and board the bus.
- 11) Same procedure as #6 (see above).
- 12) Upon arrival at site 4 (located off Beaver Road about 1,000 feet before it dumps into the Ohio River) students will follow the same procedure as outlined in #5 (see above).
- 13) Same procedure as #6 (see above).
- 14) Arrival back to school will be approximately 1:30 PM.
- 15) Students will go to the classroom (for it is now normal class time) and as a group, we will analyze the data and discuss the results.
- 16) The teams will become groups of four.
- 17) Each group will be assigned a task: **a.** Generate report for Extension Office, **b.** Generate report for Frankfort, **c.** Look for news of pollutants or spills/fish kills, **d.** Contact local officials (including water treatment) for information concerning recent violations in the area, **e.** Web Search for related information about what we've been doing, **f.** Preparation of the Manja vials, And **g.** Clean up and storage of all materials/tools.

#### **Follow up day(s):**

Students will complete their analysis of the Manja, file the reports with the proper agencies, complete their reports and turn in their data/reports. Pictures from the Reading the River Trip from 2001 and 2002 will be shared and the details of that trip compared with the one-day outing we took.

#### **Handouts:**

See attachments 1-5.

#### **Definition/Explanation of Concepts:**

Students most often experience a paper lab or notes and worksheets when it comes to stream analysis. A few are given video coverage of a local stream and asked to assess the habitat from their classroom seats. However, a carefully planned and well-executed field study can be performed to yield useful data for not only the students to analyze, but also incorporate the local and state governments as well.

The tests that are used in this lesson are simple and effective. The data collected follows the guidelines of the Water Watch program in Kentucky. The Manja tubes were developed at the Cincinnati E.P.A. office in order to determine the human fecal coliform presence in a body of water within 24-48 hours. The water color will change from its original color to black if coliforms are present, indicating there is human fecal contamination in the stream.

A macroinvertebrate sample is taken to determine the relative health of the stream. This assessment takes into account the habitat quality as well as water quality. Without habitats, the organisms cannot live there. The types of organisms present will distinguish among a poor, fair, good, or excellent stream. Organisms like water pennies, mayfly nymphs, stonefly nymphs and others are sensitive to any amount of pollution and won't grow in a polluted stream. On the other hand, blackfly larvae, leeches, aquatic worms, and pouch snails are highly tolerant of polluted waters, though they can also live

in cleaner waters as well. This is useful to know because if the leeches and such are present and the water pennies and others from their group are not, then it is likely the stream is contaminated. By using the Kentucky Water Watch Biological Monitoring Assessment Report, an actual numerical value can be assigned to the stream for its macroinvertebrate quality.

The dissolved oxygen and pH test are used in conjunction with the biological data to re-emphasize the quality of the water. An optimum pH reading would fall between 6.0 and 9.0. The dissolved oxygen test results for a warm water stream would be acceptable between 4.0 and 20 mg/l. In a cold water stream, they would be acceptable between 5.0 and 20 mg/l. If the levels are low, they may be signaling organic waste build-up.

The Habitat Assessment Field Data Sheet must be completed by the students to help determine the quality of the habitat itself. As was stated previously, no organisms are going to live in an area that does not provide shelter/habitat for them.

The physical characteristics sheet will aid the students in their assessment and memory of the site. It often provides insight to reasons for certain conditions that would otherwise have been overlooked.

#### **Assessment:**

Students will be given an open response question to complete at the close of the unit, which will encompass all that they've learned from this experience and the knowledge building up to it. They will also be assessed in their reports and fieldwork.

#### **Open Response Question**

Mary Kathryn Dickerson, of the Conservation District in Boone County, is on the phone and is requesting a complete stream analysis of Woolper Creek by next week. You and your unlimited budget and manpower promise to have that report to her no later than Wednesday next week. Explain how you will accomplish this task by giving information about the following:

- a) Where and how many sites along Woolper Creek you will assess
- b) The materials needed and manpower you will use
- c) The procedures you will utilize using the materials listed above
- d) The possible results you might obtain and what they mean
- e) What the data you've collected might be used for by the County

\*\*See attachment 6 for the rubric.

#### **References:**

Project Wet, Water Education for Teachers. The Watercourse and the Council for Environmental Education. P. 223-227, 267-270, 1995.

Watershed Watch Biological Stream Assessment Year 200 Monitoring Procedures Version 1.0. Kentucky Water Watch Program, 2000.

Watershed Habitat Assessment Protocols Version 2.0. Kentucky Water Watch Program, 1999.

Lesson Plan is an adapted version of the entire Reading the River Trip, 2002 (minus the canoes).

<b><u>Assignments</u></b>	<b><u>Site 1 Group #s</u></b>	<b><u>Site 2 Goup #s</u></b>
Manja	1 & 7	2 & 6
Macroinvertebrate sample and index	2 & 6	3 & 5
pH & habitat assess.	3 & 5	1 & 7
Dissolved oxygen	4 & 3	6 & 2
Temperature	5 & 4	7 & 1
Biological Assess. w/ cum. index	6 & 2	5 & 4
Physical Charact.	7 & 1	4 & 3

**Site 3 Group #s**

5 & 4

7 & 1

4 & 6

6 & 7

3 & 2

1 & 3

2 & 5

**Site 4 Group #s**

4 & 3

4 & 1

2 & 7

1 & 5

6 & 5

7 & 2

6 & 3

RUBRIC!

Item to be Assessed	Distinguished	Proficient	Apprentice	Novice
Where the analysis will take place and the # of sites	Several sites are carefully chosen w/ explanation and the # is appropriate for the length/flow with explanation	Several sites are chosen and the number is appropriate for the length/flow of the stream	A few sites are chosen at random and the number is not necessarily appropriate	One site is chosen randomly
Materials required and manpower needed	An extensive list of materials is given and the necessary manpower is addressed with explanation	An appropriate list of materials is given and the manpower is addressed	Some materials are listed and the manpower is mentioned	Few or no materials listed and manpower is neglected
Procedures for using the equipment and performing the analysis	Elaborate explanation of procedures for performing the test is given	Explanation of procedures for performing the tests is given	Some explanation is given for performing some of the tests	Little or no explanation is given for performing the tests
Results you may obtain, what those results mean, and for what the data might be used by the county	Elaborate explanation of possible results w/ complete analysis of their meaning as well as a couple of possibilities for county use	Explanation of possible results w/ analysis of their meaning as well as a possibility for county use	Some explanation of possible results w/ little analysis of their meaning as well as a possibility for county use	Little or no explanation of possible results w/ little or no analysis of their meaning. County use is not addressed
Flowing ideas, complete sentences, correct punctuation, spelling, and grammar	1-2 errors that do not retract from the quality of the piece	3-5 errors that do not retract from the quality of the paper	6 + errors and paper still flows logically	6+ errors and paper does not flow