

Reading the River, Summer 2002

River Investigations:  
Selected Topics for 9/12 grade science

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# Mapping the Biotic and Abiotic Components of a River Ecosystem

Grade Level: 9/12

## Objectives

The students will be able to;

- 1.) Select, survey and map a potential site to conduct their investigations along a river and/or tributary.
- 2.) Collect and classify various biological, chemical and physical samples.
- 3.) Compare and contrast these variables to the river as a whole.
- 4.) Design and create a large to scale wall map from their collected data.

## Programs of studies:

### Scientific inquiry

\*) Use appropriate equipment, tool techniques, technologies (e.g. power point presentations, creating interactive web sites), and apply mathematics to improve scientific investigations and communications. (e.g. integrate mathematical equations with math class).

\*) use evidence, logic and scientific knowledge to develop and revise scientific explanations and models. (e.g. Create a new map each year to provide a scope and

sequence in understanding a changing river based upon the collected data).

\*) review and analyze scientific investigations and explanations of other investigators, including peers.

### Applications/Connections

\*) explore the impact of scientific knowledge and discoveries on personal community health issues....

### Core Content

#### Biological Change

SC-H-3.4.3 Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their relationships.....

SC-H-3.5.1 Atoms (e.g. carbon, oxygen, nitrogen) and molecules (e.g. water) cycle among the living and nonliving components of the biosphere.

SC-H-3.5.2 Energy flows through ecosystems in one direction from photosynthetic to herbivores to carnivores and decomposers.

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 of years.

## The Interdependence of Organisms

SC-H-3.5.4 Living organisms have the capacity to produce populations of infinite size. However behaviors, environments and resources influence the size of populations. Models (e.g. mathematical, physical and conceptual) can be used to make predictions about changes in the size or rate of growth of a population.

SC-H-3.5.5 Human beings live with in the world's ecosystems. Human activities can deliberately or inadvertently alter the dynamics in ecosystems.....

### Materials

- 1.) Student notebook.
- 2.) Plastic PCP pipes connected to form 1 meter squares.
- 3.) Several lines measured out to 50 meters in one meter increments.
- 4.) Colored pencils.
- 5.) Field guides: micro/macro invertebrates, fresh water mussels, KY fish, birds and plant life etc.....
- 6.) Lamotte physical and chemical water test kits, field scopes and magnifiers.
- 7.) Homemade underwater viewing scopes.
- 8.) Topographical map of the region and/or hand held G.P.S meter.
- 9.) Cameras- digital, film, and video.

## Activity Procedure

- 1.) Have students select, survey and measure out a site on a river or tributary.
- 2.) Locate the selected area on the topographical map or record the coordinates from a hand held G.P.S meter.
- 3.) Assign students into the following collection teams:
  - Biological
  - Microinvertebrates
  - Macroinvertebrates
  - Fauna and Flora
  - Habitat
  
  - Chemical
  - pH
  - Dissolved oxygen
  - Conductivity
  
  - Physical
  - Substrate Turbidity
  - Temperature
  - Flow rate
- 4.) Back in class the teams will analyze and collaborate collected data and deliver their findings in the form of presentations.
- 5.) The students will then recreate to-scale a working model of their field investigations on to a large wall map.

- 6.) Each team will contribute their findings to the finished product.
- 7.) Based on the working variables presented, students in the other science subject areas will be able to hypothesize and extrapolate future changes in the river.
- 8.) Have student create computer generated programs so that when students manipulate the variables such as pH, Dissolved oxygen, runoff, substrates, conductivity and habitats they can see how the cause and effect will affect the biotic and abiotic components of the river and surrounding environment.

### Follow-up-activities:

- \*) Invite guest speakers who are knowledgeable in the fields of river ecology and land management
- \*) Field trip to sanitation treatment sites with prearranged questions.
- \*) Have designated students provide presentations to other classes and possibly other schools.
- \*) Recruit parents and other community members to aid in our investigations.
- \*) Set-up a website with neighboring schools upstream and/or downstream who are also monitoring their river in order to compare and contrast data.

## Definition/Explanation of concepts:

- When some people look at a river they only perceive the obvious moving water, still water, clear, murky, was that a fish? But with the proper training ones level of awareness is acutely raised. One doesn't merely look at a river any more but one will see the river.
- With proper training and practice a student will become much more aware of how the abiotic and biotic components interact and affect the river as a whole.
- Abiotic factors such as temperature, pH, dissolved oxygen, phosphates, flow rates, substrates, conductivity and the water shed will have a direct bearing on the living organisms. These include micro and macroinvertebrates, mussel population, algae, plants, fish and the animals that come to the river to feed and drink. In turn this will impact the surrounding community that uses the river as a resource.
- In the past the attitude of “out of sight out of mind” just throw it in the river it will go away can no longer be tolerated. We have witnessed the results of irresponsible practices and paid the price. Poor agriculture and land management, pesticides and runoff. Live stock urinating and defecating in our rivers. Which

will have devastating impacts on the inhabitants down river.

- Only through education and practice can we change these attitudes and raise awareness that our actions dictate the health of our water ways. We must understand that we have to take in the water shed as a whole. From point of origin to where it empties out. How pH, dissolved oxygen, flow rates, conductivity and substrates will affect organisms that are sensitive to changes in their environments. How important it is that certain species need certain types of habitats. Because in the long run we as a community will prosper or suffer the consequences.

### Assessment:

- 1.) Evaluate through verbal discussions and brainstorming sessions individually or in groups using the inquiry approach.
- 2.) Monitoring and assisting in student research, preparations and presentations.
- 3.) Placing a topical question through seven levels of critique.
- 4.) Have students demonstrate and explain various lab techniques in detail.
- 5.) Respond to the following prompt:

“ You have observed a prominent citizen spraying a very toxic pesticide on his lawn that borders a river bank. As far as he is concerned it is not against the law and he is not harming anyone anyway. Explain how you would otherwise convince him of the overall impact he will have on the environment”.

References: The ideas in this lesson were inspired from the following’;

Pond Life (2001) (re.ed) by George K. Reid under the editorship of Herbert S. Zim and George S.Fichter.

Natural History Collecting (1972) by Reg. Harris

The monitors handbook (2001) by Gayla Campbell and Steve Wilberger

A water Odyssey in Kentucky (2002), A publication. Kentucky Association of Conservation Districts.