Riparian Review - Stream Side Science

Summary

In this exercise, students will identify and observe biotic factors in a riparian ecosystem, which is the green strip of vegetation alongside a waterbody; they will measure the types of vegetation at the water's edge, the function of plants as ground cover and canopy cover, and observe the wildlife in the area.

Time Frame

1 class periods of 70 minutes each

Materials

Flagging
Measuring tapes*
Ocular tubes*
Copies of the student worksheets (pdf)
Copies of the riparian zone instruction sheets (pdf)
Copies of wildlife observation instruction sheets (pdf)
- Wildlife checklists (pdf) (optional)

Clip boards
Pencils
- Plant guides (pdf) (optional)

* For information on equipment for loan or for purchase, contact USU Water Quality Extension at (435) 797-2580 or www.extension.usu.edu/waterquality

Background for Teachers

Purpose
To observe and list biotic factors that affect a given ecosystem.
Background
Riparian areas are the transition zone between aquatic and terrestrial systems. The plants in this zone depend on high water tables and flooding patterns associated with the aquatic systems. Riparian zones cover a very small area in a watershed, but are extremely important.
Riparian Zone Functions:

Bank stability to resist erosion
Habitat for a diverse community of plants and animals
Canopy cover which provides shading
Organic materials drop from canopy cover into waterbodies
Soils soak up water from runoff and prevent flooding
Healthy riparian areas protect the land from flooding, and provide storage for a sustained summer flow

For more background information, see:

The Riparian Zone section (pdf) of the Utah Stream Team Manual which defines a riparian zone and discusses how it would change due to natural and human influences, why the riparian zone is important in an aquatic ecosystem, and how to measure and interpret the results.
For information on Utah's wildlife, see the Utah Division of Wildlife Resources Data Center website.

Intended Learning Outcomes

- Use Science Process and Thinking Skills
  - Observe objects, events and patterns and record both qualitative and quantitative information.
  - Distinguish between factual statements and inferences.
  - Develop and use classification systems.
  - Construct models, simulations and metaphors to describe and explain natural phenomena.
  - Use mathematics as a precise method for showing relationships.
  - Form alternative hypotheses to explain a problem.
- Manifest Scientific Attitudes and Interests
  - Raise questions about objects, events and processes that can be answered through scientific investigation.
  - Maintain an open and questioning mind toward ideas and alternative points of view.
  - Evaluate scientifically related claims against available evidence.
- Demonstrate Understanding of Science Concepts, Principles and Systems
  - Know and explain science information specified for the subject being studied.
  - Apply principles and concepts of science to explain various phenomena.
  - Solve problems by applying science principles and procedures.
- Communicate Effectively Using Science Language and Reasoning
  - Provide relevant data to support their inferences and conclusions.
  - Use precise scientific language in oral and written communication.
  - Use proper English in oral and written reports.
  - Use reference sources to obtain information and cite the sources.
  - Use mathematical language and reasoning to communicate information.
- Demonstrate Understanding of the Nature of Science
  - Science is a way of knowing that is used by many people, not just scientists.
  - Understand that science investigations use a variety of methods and do not always use the same set of procedures; understand that there is not just one "scientific method."
  - Science findings are based upon evidence.
  - Understand that science conclusions are tentative and therefore never final.
  - Understandings based upon these conclusions are subject to revision in light of new evidence.
  - Understand that scientific inquiry is characterized by a common set of values that include logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results and honest and ethical reporting of findings. These values function as criteria in distinguishing between science and non-science.

Instructional Procedures

Classroom Activity:

Define the term riparian zone. *The riparian zone is the green ribbon of vegetation along a stream, and the associated animals that live in or use this area.* Talk about why a riparian zone is important to the health of an aquatic ecosystem, natural changes in the riparian zone, and also what humans do to alter the riparian zone.

Ask the students to list all the biotic factors they can think of in a riparian system *(e.g., types of plants, specific plants and animals*). Ask them to think about how this community of plants and animals might be different from those found in a deep forest, in open range land or in their back yards. How might they be similar?

Explain to the students that they will be going out to a stream site to evaluate the structure and function of the riparian area. These functions include both the riparian vegetation and wildlife.

They will also use other techniques to observe or find evidence of animal activity.

Explain to them what measurements they will be taking and why. Measurements:

Greenline - they will measure the type of vegetation that grows closest to the water's edge. This is an indication of the bank stability. See Further Discussion question number 1 for more information.

Ground Cover - they will record the width of the zone in which riparian plants grow.

Canopy Cover - they will measure the amount of shade the riparian plants provide.

Wildlife Signs - they will identify animals and signs of animal activity.

Because there are four sets of measurements, we strongly recommend reviewing the actual measuring procedures with the class before going into the field.

Field Activity:

Divide your students into groups of no more than six students.

Assign each group with a measurement (greenline, ground or canopy cover or wildlife signs) and provide them with the appropriate materials.

Greenline Group	Ground Cover Group
Flagging	Measuring tape
Measuring tape	Ground cover sampling
Greenline sampling instructions	instructions
Greenline worksheet	Ground cover worksheet
Canopy Cover Group	Wildlife Group
Ocular tube	Binoculars
Measuring tape	Wildlife worksheet
Canopy cover sampling	Wildlife observation instructions
instructions	Checklists (optional)
Canopy cover worksheet	Field guides (optional)

Explain to the students that each group will take a different measurement, and share their data with each other back in the classroom.

NOTE: If time allows, you can have the groups do more than one of the measurements.

Review the sampling instructions for each particular measurement. Have the students fill out the site observations section of the student worksheets before beginning their measurements.

Have the students record their results onto the student worksheets. You can choose to have one record keeper per group, or have each student record all the information. You may also want to suggest to your students that they take turns conducting the measurements throughout the process.

Applying the Data:

Map the stream segment -- e.g., width of riparian zone, areas with canopy cover, different types of plants.

Compare (graphically) different reaches of a river -- e.g. a more developed area versus a pristine one, such as a city site versus the headwaters.

Discuss big rivers versus small streams - how do the functions of riparian zones differ?

Further Discussion:

1. How do the greenline measurements help us understand how well a stream bank resists erosion?

   Fast moving water can cause banks to erode. The greenline is a measure of how well the plants along the water's edge will help the banks resist erosion (bank stability). We determine stability by calculating the proportion of different vegetation types. These are sedges and rushes, shrubs and trees, grasses, forbs (a non-woody plant that is not a grass) and bare ground. Each vegetation type has a different ability to stabilize the banks due primarily to the depth and

density of the roots, and whether they are annuals (die back after one year) or perennials (live through the winter). For example, sedges are perennials that have deep, thick root masses that cling to and stabilize soils, while many annuals have shallow or sparse roots that do not contribute to bank stability.

In the field, look at the vegetation in areas where serious erosion has occurred compared to areas with stable banks. Think about how different land uses affect vegetation and therefore bank stability.

2. How does the canopy cover affect the physical properties of the stream itself?
   Canopy cover provides shade and is important in keeping water temperatures low in small "headwater" streams. Many fish and other aquatic organisms are sensitive to high temperatures, and may disappear from streams that have lost their shade.

   The canopy of a stream also represents the leaves and debris that may fall directly into the stream. This external input of material is an important source of food and shelter for the fish and other organisms living in these small streams. The relative importance of canopy cover (both for shade and for input of organic material) decreases as a river gets increasingly larger.
3. How do humans affect the health of the riparian zone?
   The riparian zone is a very small area compared to the entire land area of a watershed, and humans can have a serious impact on this important ecosystem through different types of activities.
   - *Clearing: Riparian areas are often cleared for agriculture, logging, or housing and other development. This can lead to destabilized banks, heavy erosion and loss of stream and riparian functions.*
   - *Introduced species: Many riparian areas are affected throughout the world by introduced species, which take over the riparian area and radically change the habitat. Species such as russian olive, tamarisk, and purple loosestrife may form "monocultures," replacing native plants and resulting in a serious loss of plant and animal diversity and a loss in other riparian functions such as storing and filtering wastes.*
   - *Grazing: While grazing by cattle and other livestock has been shown to be compatible with healthy riparian areas, the type of grazing is extremely important. Most riparian areas can handle short term, "intensive" grazing, with sufficient recovery time. Continuous grazing in a riparian area can limit the plants' abilities to recover and may ultimately lead to loss of vegetation or a change in species.*
   - *Recreation: Recreationalists flock to riparian areas, but may "love them to death." Trampling, multiple trails, wood removal for campfires, and littering all can impair riparian areas.*
4. Why would a stream area be a good habitat for wildlife?
   The diversity of plant species (from small annuals to dense sedges to tall trees) provides food and shelter for a wide diversity of animals, ranging from insects to birds to mammals. One function of riparian areas that people sometimes neglect is their use as a "corridor" for wildlife, providing connecting routes across otherwise dry or uninhabitable landscapes. These corridors are important not only for migration, but also for connecting different breeding populations.

Extensions

Compare your results to results from other streams or other locations on the same stream.
Sample the same station on multiple dates (fall vs. spring) to compare results.
Use the activity What's in the Water? to collect chemical measurements in the stream. Have students hypothesize about the links between the riparian zone and the water chemistry. See discussion questions.

Bibliography

Lesson plan authors: Andree Walker and Nancy Mesner (Utah State University Water Quality Extension)
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Additional resources can be found on the USU Stream Side Science 9th Grade Curriculum web page.

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