

Restoring A Stream

VIRGINIA SOL

- Science 6.7, LS.12
- Social studies CE.1, CE.3
- Language arts 6.6, 7.7, 7.8, 8.7
- Technology C/T8.1, C/T8.2

OBJECTIVES

- Research the importance of protecting and restoring streams
- Understand the accepted meaning of stream restoration
- Focus project on designing, establishing, and maintaining streamside forest buffers
- Identify a local stream habitat in need of protection and restoration
- Plan an action project to protect and restore the local stream habitat
- Seek technical assistance from local and state agencies and cooperation of landowners
- Work to return a waterway to former water quality and stability
- Use photos and journal records to document and share progress of restoration project
- Plan to measure success of project by monitoring the waterway following restoration work

MATERIALS

- Planting bars or shovels
- Plants
- Bags or buckets for plants
- Water for the plants
- Survey tape to mark plants
- Wood stakes to mark planting area
- Tubes with nets to protect seedlings
- Camera and first aid kit

SAFETY & REGULATIONS

See Planning a Safe Trip in the Introduction section of this packet and Safety at the Stream at the end of this lesson. Adult chaperones will be needed for visits to the water site. See also the Riparian Planting Day Checklist handout for students.

TIME NEEDED

This lesson is written as a long-term project.

What practical steps can we take to protect and restore the habitat at a local stream?

Protecting our water resources through restoration helps students understand watersheds as dynamic systems that are powerful, and at the same time fragile. Protecting even small streams is crucial for the Chesapeake Bay's recovery and the water quality in our own area. In addition to offering a meaningful field experience, this project activity supports SOL in different disciplines. The activity is intended for seventh grade Life Science. Sixth grade Science SOL 6.7 includes the health of ecosystems and major conservation, health, and safety issues associated with watersheds. Seventh grade SOL LS.12 specifically concerns relationships between ecosystem dynamics and human activity. This includes factors threatening and enhancing species survival and issues of water supply and waste management. Social Science SOL CE.1 and CE.3 for seventh grade include citizenship skills such as identifying problems and

recommending solutions, and civic and social duties addressing community needs.

In this lesson, students will learn about the stresses our aquatic ecosystems are under, and then plan and



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participate in a streamside restoration project. They will monitor the results of their restoration project, and then document and share those results.

Virginia's growing population, accompanied by intensified residential and commercial development, is bringing increases in many land use activities that place increased stress on aquatic ecosystems from the smallest stream to the Chesapeake Bay. For example, as we increase the amount of impervious surfaces near our streams, including parking lots, roads, and rooftops, the volume and velocity of water directed into the streams increases. This tends to lead to increased soil erosion from the land surface around streams. Impervious surfaces are also the source of thermal pollution, as rainwater runs from a hot parking lot or rooftop, warming nearby streams.

This project will focus on restoring a stream through the planting of native trees and shrubs (available for purchase from the Virginia Department of Forestry). Planting vegetation by a waterway is a relatively easy and widely used tool for stream bank protection, particularly for small tributaries. In Virginia, some of our biggest water pollution issues are sedimentation and excess nutrients. As students will learn, a buffer planted alongside a stream or river will help reduce these problems while sustaining a healthy stream environment. For schools in coastal areas, the project can be modified so that students learn about the need to reintroduce submerged aquatic vegetation (SAV) into tidal rivers.

TIME TO RESTORE

Aldo Leopold, a forester, author, and preservationist who wrote about our ethical responsibilities in protecting natural areas, said, "The time has come for science to busy itself with the earth itself. The first step is to reconstruct a sample of what we had to begin with." He, and many others today, believe in repairing the damage that has been done to the nation's aquatic resources: lakes, rivers, bays and wetlands. Chesapeake 2000, the latest Chesapeake Bay Agreement signed by Virginia and other states in the watershed, calls upon schools to help restore and protect streams and wetlands.

By successfully establishing a riparian buffer zone, students will accomplish a meaningful experience in water resource stewardship. Healthy rivers, bays, lakes, and even the smallest streams perform numerous environmental functions that are very valuable to plants, animals, and humans. Benefits can be economic, environmental, recreational, or aesthetic. The following list includes some of the specific benefits of riparian buffers.

- Providing shade and reducing water temperature in streams, improving habitat conditions for frogs, fish, salamanders, insect larvae, and other stream organisms.
- Providing habitat for wildlife. Shelter, food, and nesting sites for large and small animals can be found in riparian buffers. Buffers also act as corridors for animals to reach other areas of similar habitat.

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- Providing organic material such as leaves and twigs, which are food for many of the animals living in a stream.
- Diminishing the impacts of floods. Riparian buffers slow and absorb floodwaters, reducing the likelihood of flooding downstream.
- Improving water quality by trapping and absorbing nutrients that are found in water running off of agricultural fields, lawns, golf courses, etc. These nutrients are then stored in the limbs, roots and leaves instead of entering the stream.
- Promoting sediment deposition, making water clearer.
- Helping recharge groundwater by providing pathways for water into groundwater aquifers.
- Providing pleasant areas for watching wildlife, such as birds, dragonflies, frogs, and butterflies.
- The root system of the riparian trees and scrubs helps to hold the bank soil together and increase overall bank stability by an interweaving network. Also, the plant stems and foliage slow stream flow, absorbing flow energy and decreasing the amount of erosion from the stream bank.

LESSON INTRODUCTION

Researching the importance of protecting and restoring streams...

Before undertaking a restoration project, students will need to carry out some research of their own into the importance of protecting

WHAT IS STREAM RESTORATION?

According to the National Research Council, restoration means “the reestablishment of predisturbance aquatic functions and related physical, chemical, and biological characteristics.” The Environmental Protection Agency has defined restoration as “the return of a degraded ecosystem to a close approximation of its remaining natural potential.” There are many ways to restore a stream, river, or bay. These can include chemical adjustment of the water, reconstruction of physical conditions, biological manipulation, and reintroduction of native flora and fauna.

There are many benefits from carrying out stream restoration. Restoring aquatic ecosystems can reverse ecological damage before it is permanent and help maintain healthy populations of wild animals and native plants. Humans also benefit more directly when restoration improves streams for recreation and aesthetic enjoyment. Very often, there are economic benefits from acting quickly as this can then decrease future costs.

Of course, there are also methods to prevent damage or pollution in the first place. For example, in farming areas, fences can be installed to keep livestock out of streams and reduce bank erosion and fecal contamination.

and restoring streams. Lead the students so that they come to understand the accepted meaning of restoration and the benefits that are gained from restoration. Students can research information in each of the following areas.

- The importance of rivers and smaller streams
- The importance of the Chesapeake Bay

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- The riverine-riparian ecosystem
- The critical role riparian stream buffers play in protecting water quality
- Stresses on rivers and streams
- Threats to the health of aquatic ecosystems
- Benefits from restoration

After the students have completed their general research, focus them on carrying out a riparian buffer planting project. Provide the students with some background information on how to carry out a planting project, and some of the specific benefits that can be achieved by this type of restoration.

Identifying a local stream habitat in need of protection and restoration...

You will need to work with students to identify a suitable local site that is in need of protection and restoration. Possible sites might include any of the following.

- An eroding stream bank
- A park with a stream needing more riparian buffer
- Soon-to-be-developed agricultural land

ACTIVITY PROCEDURES

Planning the action project...

Goals need to be set for the stream protection and restoration project. Middle school students will need considerable help and guidance with this, and you should work together with the students to establish appropriate, achievable

goals. The U.S. Environmental Protection Agency's Office of Wetlands, Oceans, and Watersheds has developed several principles for carrying out a successful aquatic restoration project. Possible general goals include the following.

- Preserving and protecting aquatic resources.
- Restoring ecological integrity.
- Restoring natural structure.
- Restoring natural function.
- Addressing ongoing causes of degradation.

The goals that are chosen should have as local a focus as possible, in order to make the project relevant and meaningful for the students. Your goals must also be clear, achievable, and measurable. More specific goals might include the following.

- Decreasing a pollution problem. For example, the project could be designed to decrease the amount of erosion in an area or decrease the amount of nutrients entering the water.
- Increasing the wildlife population in an area, or at least stopping a decline.
- Restoring a wildlife habitat.

The school restoration project could be part of a bigger effort. The U.S. Department of Agriculture and other agencies encourage the public to think in terms of an entire stream corridor or stream valley. While a school or school class might work in just one small area, this might easily be part of a wider effort to

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restore a relatively large ecosystem. You should make contact with your local Soil and Water Conservation District (SWCD) office to learn if any larger plan exists that includes the local stream you have identified for your project. You should seek whatever assistance might be available from the local SWCD office to help the students carrying out a project. Other agencies that you can contact for help include local Extension offices, the Department of Forestry, and the Department of Game and Inland Fisheries. The Virginia Department of Environmental Quality has educational specialists who welcome opportunities to help schools with this type of project. Local and state agencies can provide help with designing project plans, and they may also be able to provide supplies or suggest sources of funding. To find phone numbers for these and other conservation contacts in your watershed, see the "Yellow Pages" that were compiled by the Virginia Department of Conservation and Recreation (www.dcr.state.va.us/sw/wsheds.htm#contacts).

Carrying out the riparian planting project...

To carry out their project, students need to gather plants and planting equipment. The plants chosen should be native plants that are suited to a streamside environment. Select plants that prefer moist to very wet soil and that can withstand occasional flooding. Virginia's Department of Forestry (DOF) has several riparian buffer packs of trees for sale including such trees as oaks, hazelnut, hackberry, buttonbush, ash, mulberry, locust,

dogwood, cherry, persimmon, sycamore, and others. Call your nearest DOF office to learn if trees can be donated to your project, and also if they have planting bars or shovels you can borrow. DOF can also give you advice on how far apart the tree seedlings should be planted.

If you are planting bare-root seedlings (which are only as thick as a pencil), students can use a planting bar which creates a narrow slit in the dirt. Working in teams of two or three, students can quickly plant dozens of these small trees. Bare-root seedlings must be kept moist until planting. If the plants are in pots with a root ball, shovels will be needed to dig larger holes. If time and budget allow, you may want to protect the seedlings by placing tubes around the young plants. When this is not possible, planting a larger number of seedlings is advised. Other equipment that will be needed for planting is listed at the beginning of this lesson. As you plan your restoration project, you may want to refer to the Pennsylvania Stream ReLeaf Forest Buffer Toolkit (see web address at end of this lesson). After planting, the area may need to be marked to protect the seedlings from accidental mowing.

When making visits to the planting site, be sure to follow all school field trip procedures. Adult chaperones will be needed. Also, refer to the Planning a Safe Trip information in the Introduction section of this packet and the Safety at the Stream information at the end of this lesson. At the end of the lesson there is also a Riparian Planting Day Checklist for students.

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A measure of the success of a restoration project can be obtained by water quality monitoring. Ideally, monitoring should be carried out before, during, and after the restoration project. Tests to carry out could include temperature, turbidity, dissolved oxygen, nitrogen, and records of observed wildlife. See the Water Quality Monitoring chapter and the Evaluating a Stream lesson in this section for more information.

Documenting and sharing progress of the project...

Have students record and document the progress of the restoration project by taking photos and writing journals. If digital cameras are available, photographs taken can be imported into typed journals.

Project results can be shared by having students create posters for the classroom, school, and neighborhood. Students could also create and distribute newsletters or brochures. You might choose to have students use computer technology and practice skills from the Virginia Computer/Technology Standards of Learning. Using advanced publishing to produce page layouts would support SOL C/T8.1, and developing web pages to share project results would support SOL C/T8.2.

QUESTIONS

- What is meant by stream restoration?
- What are some steps that can be taken to restore a stream habitat?
- Which trees and shrubs are best for planting beside streams?
- How does the health of our stream site compare with other streams nearby?
- What are some general benefits of restoring a stream site?
- What are some specific benefits of creating a riparian buffer zone?
- How successful was our stream restoration project?
- Which of our project goals were achieved successfully?
- How do you imagine our stream site will be five years from now?

ASSESSMENTS

- Research reports on stream restoration and benefits from stream restoration.
- Journals documenting the stream restoration project. Digital camera photos can be incorporated into typed journals.
- Posters, newsletters, or brochures to share information about the stream restoration project.

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EXTENSIONS

- Instead of planting a streamside buffer, schools in coastal areas might want to focus on the issue of submerged aquatic vegetation, and undertake a project to help restore underwater beds of grasses. Like streamside trees and shrubs, submerged aquatic vegetation reduces shoreline erosion and provides animals with food and habitat. Contact the Alliance for the Chesapeake Bay for school project ideas. The Chesapeake Bay Foundation (CBF) has several restoration projects for schools, including restoration of underwater sea grass beds, oysters, oyster reefs, and shad. CBF also offers restoration field trips for students and teachers, as well as assistance in building large-scale community restoration projects.
- To raise awareness about the importance of forest buffers along Chesapeake Bay tributaries, the Virginia Department of Forestry, the Alliance for the Chesapeake Bay and other groups coordinate native tree seed collection throughout Virginia's Chesapeake Bay watershed. Acorns and other seeds are then used to grow seedlings to be planted along our rivers and streams to provide habitat, stabilize our riverbanks, and protect water quality. Contact your local Department of Forestry office or the Alliance for the Chesapeake Bay for details.
- Visit an area farm where the farmer has added best management practices that include riparian buffer plantings. Contact

your local U.S. Department of Agriculture or Soil & Water Conservation District office to ask for their assistance in setting up such a field trip.

RESOURCES

For the teacher...

- *Alliance for the Chesapeake Bay* www.acb-online.org
- Chesapeake Bay Foundation www.cbf.org
Restoration projects: www.cbf.org/site/PageServer?pagename=edu_educators_restoration_index
- Ecological Restoration. Munro, J. W. (1999). *The Volunteer Monitor*, 11(1), 1–5.
- *Give Water a Hand*. www.uwex.edu/erc/gwah
A national watershed education program designed to involve young people in local environmental service projects. A program of the University of Wisconsin - Environmental Resources Center.
- Humpty Dumpty. *Project WET*.
- Learning Science Through Restoration. Martin, J. (1999). *The Volunteer Monitor*, 11(1), 22.
- *Pennsylvania Department of Environmental Protection* www.dep.state.pa.us

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Pennsylvania Stream ReLeaf Forest Buffer Toolkit: www.dep.state.pa.us/dep/deputate/watermgt/WC/Subjects/StreamReLeaf.htm

The Pennsylvania Stream ReLeaf Forest Buffer Toolkit is one of the best resources online as you plan your restoration project.

- U.S. Environmental Protection Agency
www.epa.gov
EPA River Corridor and Wetland Restoration:
www.epa.gov/owow/wetlands/restore
Free single copies of Document EPA 841-F-00-003 Principles for the Ecological Restoration of Aquatic Resources (2000) are available from the web site or by calling 1-800-490-9198.
- Protecting Our Watersheds. Earth Force GREEN.
- Restoration Resources. (1999). The Volunteer Monitor, 11(1), 20–21.
- Riparian Retreat. Aquatic Project WILD.
- Virginia Department of Forestry
www.dof.state.va.us
Riparian buffer information:
www.dof.state.va.us/rfb/rfb-intro.shtml
Resources for teachers:
www.dof.state.va.us/coned/index.shtml

STUDENT HANDOUT

Riparian Planting Day Checklist

SAFETY AT THE STREAM

(SOME OF THESE IDEAS FROM THE “STREAM SENSE”
ACTIVITY BY PROJECT WET.)

For the teacher...

- Make sure the stream site is safe for students. Check the stream depth, velocity, and temperature. Also, check for walking conditions, litter, potentially dangerous wildlife, and poisonous plants.
- Bring a first aid kit on the trip.
- Define the boundaries for your visit. Make sure students understand that staying within these boundaries protects both them and wildlife.
- Locate a place where students can wash hands after the visit.

For the students...

- Stay with group members at all times.
- Wear old shoes or boots because they will likely get wet and muddy. Keep shoes on at all times to protect feet from harm.
- Stay in the designated area, and do not go near or into the water except to collect water samples.
- Do not touch any wildlife that you find or taste any water or plants.
- Learn what poison ivy and poison oak look like, and avoid these plants.
- Do not eat any food without first carefully washing your hands.

Riparian Planting Checklist for Students

EQUIPMENT AND MATERIALS FOR THE PLANTING

- Planting bars or shovels
- Plants
- Bags or buckets for the plants
- Water for the plants
- Survey tape to mark plants
- Wood stakes to mark planting area
- Tubes to protect seedlings
- Nets to place on top of tubes

CLOTHES TO WEAR

Make sure you wear proper clothes for the planting. Remember it might be colder by the water.

- Gloves and sturdy shoes or boots
- Hat (for shade or warmth)
- Long pants that can get dirty
- Dress in layers for warmth – long pants, turtleneck, sweater, jacket, windbreaker, and hat

- Bring wool or waterproof clothes for wet weather
- Bring additional warm clothes with you

OTHER ITEMS TO BRING

- Drinks (1 quart)
- Bag lunch and snacks
- Sunscreen
- Sunglasses
- Change of clothes in case of getting wet
- Camera to document planting

SAFETY DURING THE PLANTING

- Stay with your group members at all times.
- Do not go near or into the water.
- Keep your shoes on at all times to protect your feet from harm.
- Do not touch any wildlife that you find or taste any water or plants.
- Learn what poison ivy and poison oak look like, and avoid these plants.
- Do not eat any food without first carefully washing your hands.

NOTES