THE WATERSHED APPROACH: INTEGRATING YOUR BACKYARD TO THE CHESAPEAKE BAY

Scott A. Sinex
Department of Physical Sciences
Prince George's Community College
Largo, MD 20774-2199

Rainfall or any form of precipitation collects on lawns, streets, and fields and runs into storm drains (piped to streams) or directly into streams. The state of Maryland has approximately 27,000 kilometers of streams, or 1 kilometer of stream per square kilometer of land. Approximately 90% of these streams drain water which eventually flows into the Chesapeake Bay. As the water makes its journey from Hagerstown or Easton, it passes through agricultural and/or urbanized areas, eventually reaching a larger river, such as the Potomac, Gunpowder, or Choptank, and finally flows into the Bay. Along its journey, the water may have picked up fertilizers, pesticides, deicing road salt, oil from parking lots, and suspended sediment from the erosion of land. How can you make a difference in the protection of one of Maryland's treasured natural resources?

The state of Maryland has adopted a tributary basin strategy, dividing its land into ten major drainage basins or watersheds. The overall goal is to further improve the health of the Chesapeake Bay by reducing nutrients (nitrogen and phosphorus), suspended sediments, and toxic chemicals entering the water. This goal is shared by all six states, and the District of Columbia, in the Chesapeake Bay watershed. How can you contribute to this effort? We will explore some possibilities in this article.

As educators, our major responsibility to the young residents of Maryland is to enhance their understanding and appreciation of the watershed approach. This approach provides the connection of your local or backyard stream, and its surroundings, to the Bay and its watershed. Your local stream may be a **small part,** but it is **vital part** of the overall picture. The watershed approach has a two-fold benefit: cleaner, healthier local streams, and; the restoration and protection of the Chesapeake Bay.

THE WATERSHED APPROACH AND TRIBUTARY STRATEGIES

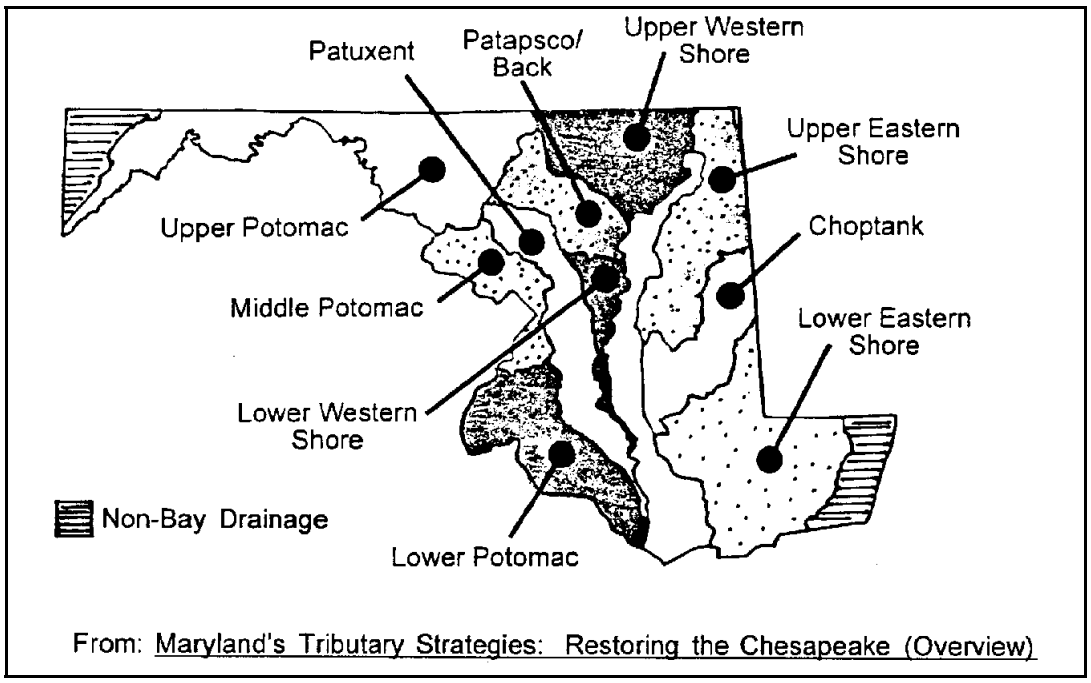
A watershed (or drainage basin) is the area of land collecting water that drains into a stream. Watersheds are separated by drainage divides, which are topographic highs, or ridges, between basins. The Chesapeake Bay's watershed occupies an area of 165,700 square kilometers in Maryland, Virginia, West Virginia, Pennsylvania, New York, Delaware, and the District of Columbia. In a simple model, the watershed is a funnel that drains into a container - the Chesapeake Bay. The top edge of the funnel is the drainage divide. What goes into the funnel eventually drains into the Bay. The list of possible materials include atmospheric deposition (both wet and dry), fertilizers and pesticides from agricultural and residential land, effluent from

wastewater treatment plants, spills of petroleum and other chemicals, and soil/sediment eroded from the land.

The state of Maryland has taken its part of the Chesapeake Bay watershed (25,000 square kilometers) and divided it into ten major tributary basins or subwatersheds. Maryland contains only 15% of the Chesapeake Bay watershed, but we have 30% of the watershed population. The basins are shown in the map below. Each basin will develop its own strategy for improving watershed quality; however, the first step in each basin is nutrient reduction to 1985 levels. The overall results to date for the entire Bay watershed can be found in Achieving the Chesapeake Bay Nutrient Goals: A Synthesis of Tributary Strategies for the Bay's Ten Watersheds, EPA Chesapeake Bay Program (October 1994). As the efforts continue, a major consideration is financing the future programs. The possibilities are outlined in a recent report Financing Alternatives for Maryland's Tributary Strategies by the Governor's Blue Ribbon Panel (available from the Governor's Office).

One of the revenue sources is a possible lawn and garden fertilizer surcharge (tax). Discuss before and after the activity. See if opinions change after an understanding of how your backyard is connected to the Bay.

Which basin is your home or school located in?



From: Maryland's Tributary Strategies: Restoring the Chesapeake (Overview)

The overall condition of the Bay is described in The State of the Chesapeake Bay edited by the Maryland Department of the Environment (available from EPA Chesapeake Bay Program).

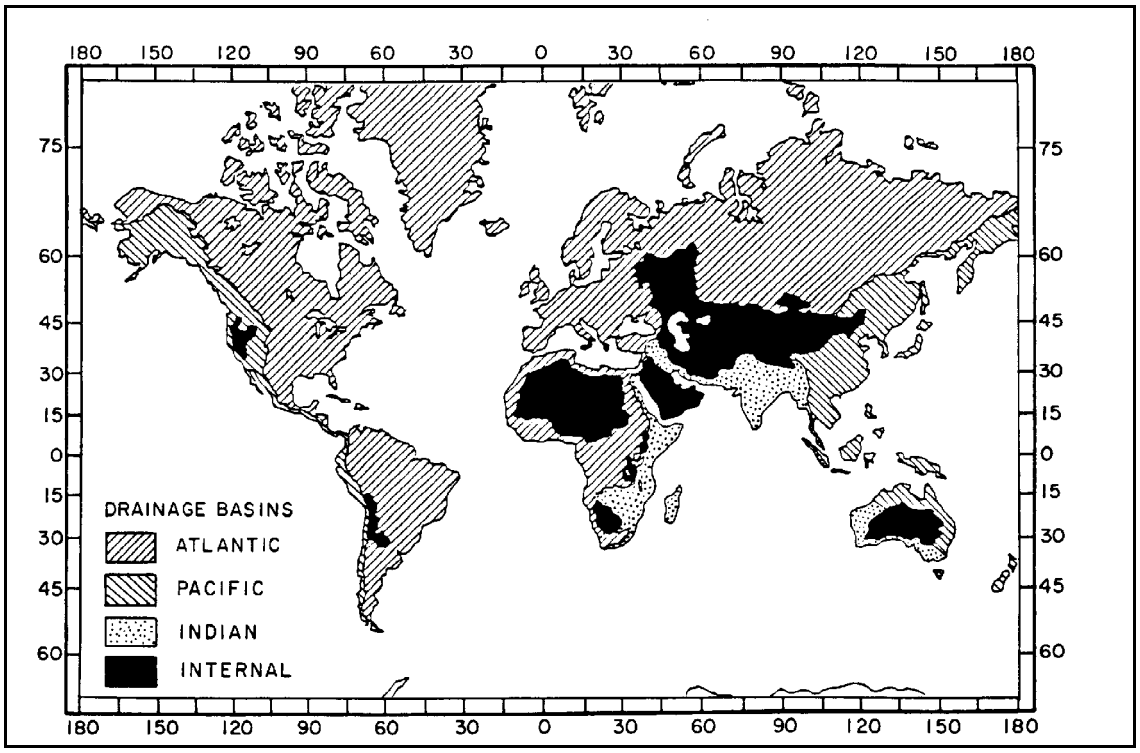
WATERSHEDS- FROM GLOBAL TO REGIONAL TO LOCAL

On the maps on the next several pages, we will explore watersheds at a changing scale starting at global drainage and working our way to your backyard, much smaller, local watershed. A variety of colored pencils or markers are helpful in this activity. The map below shows the drainage of the continental areas into the various ocean basins (Atlantic, Pacific, or Indian Oceans). The black areas are deserts from which no drainage to the oceans occur.

Color the drainage basins.

Which ocean receives the largest amount of continental drainage?

Where does most of the U.S. drainage go?



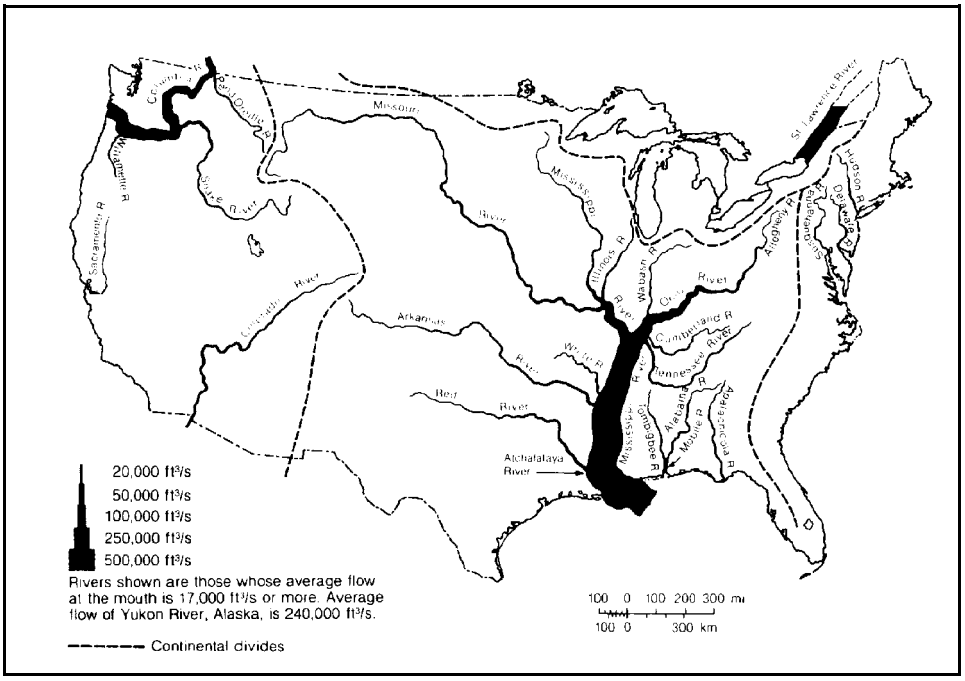
All of the maps in this section are available as full page maps in It Starts in My Backyard: An Environmental Resource Guide for Elementary Teacher by Sinex, Panyon, and Lauffer (PGCC Press, 1992).

Now consider the drainage in the continental United States. Color the different basins which are separated by the dashed lines. These lines are the drainage divides which on the scale of a continent are referred to as continental divides.

What is the largest drainage basin in the U.S.? What major river is it associated with?

What north-south geological features provide the separation of the major U.S. basins?

Mark your present location on the map. Where does water drain?



The drainage basin for the Chesapeake Bay is shown on the next page. Approximately 165,700 square kilometers of land drain into the Bay which occupies about 5600 square kilometers. About 25,000 square kilometers (or 15%) of the watershed are in the state of Maryland.

Using a regular black pencil, lightly shade the portion of the Bay watershed in Maryland.

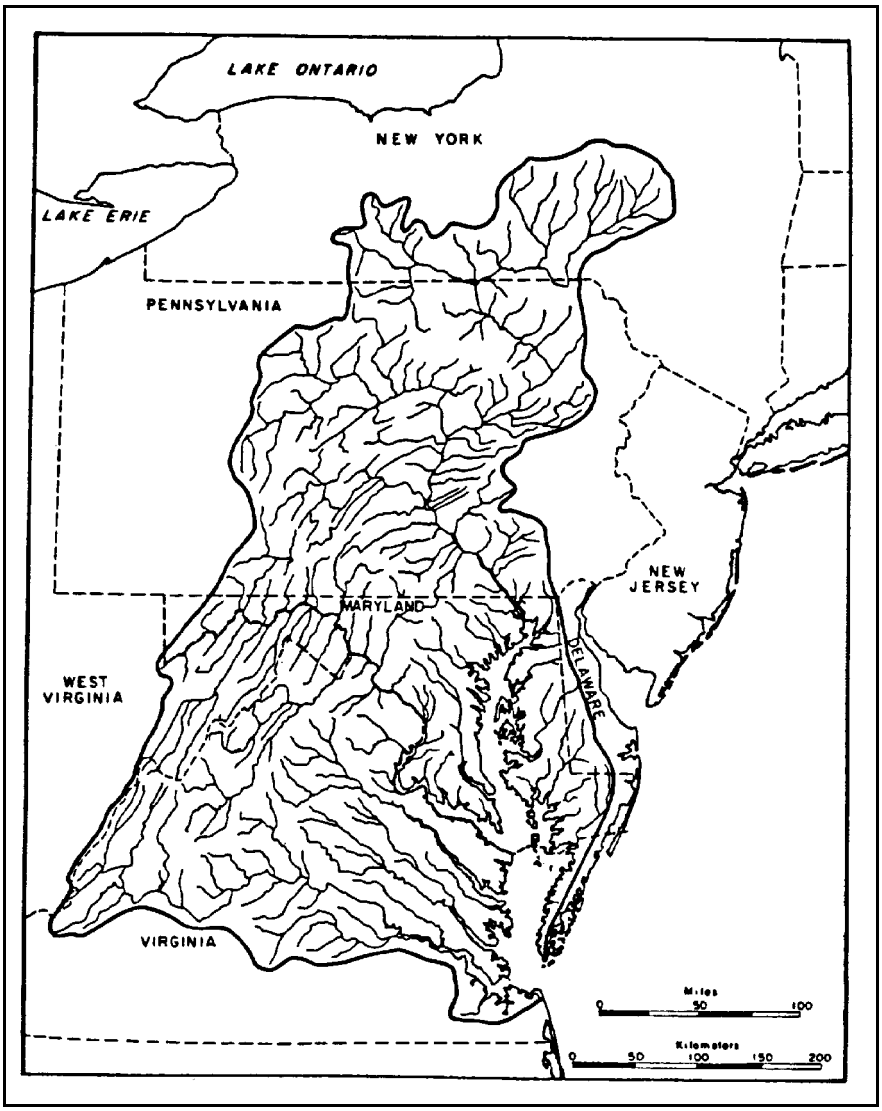
Does all the stream drainage in the state of Maryland flow into the Chesapeake Bay? If not, where does it go? Shade any non-Bay drainage in red on the map.

Locate the following major rivers (James, Patuxent, Potomac, Rappahannock, Susquehanna, and York) and outline their drainage in the watershed. Using different colored pencils, color the streams flowing into each major river. This will enhance the various river watersheds.

What states contribute drainage to the Bay?

Which river contributes the largest amount of water based on basin area? smallest amount?

Compare the relative sizes of the Chesapeake Bay with the Delaware Bay and the Great Lakes.



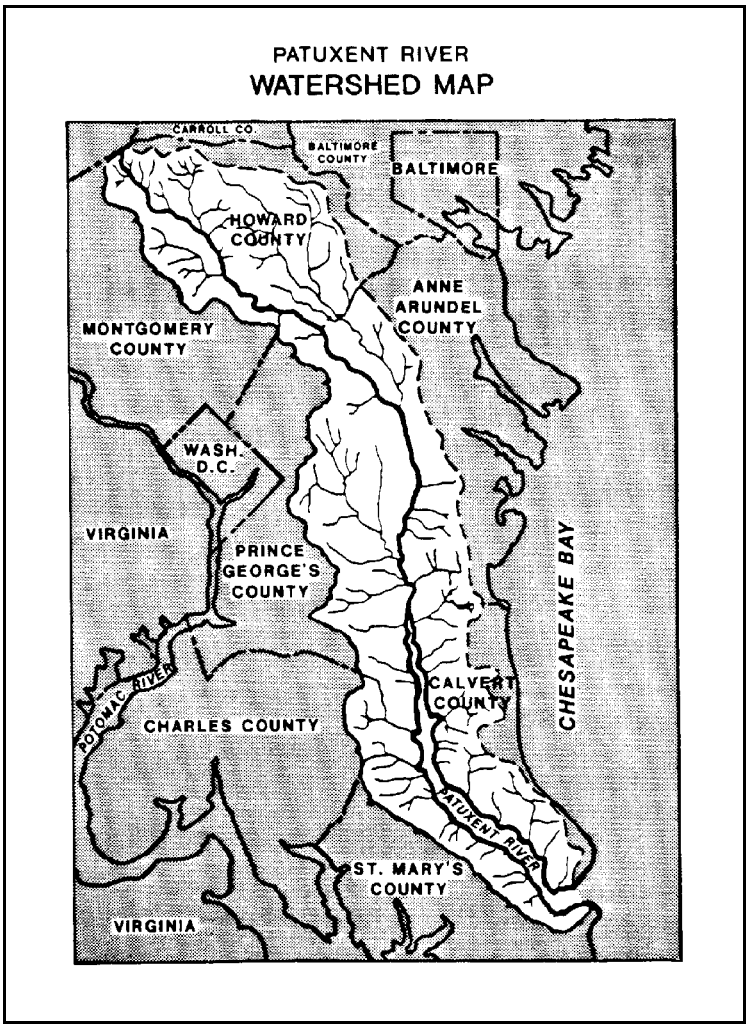
The Susquehanna River is the largest river draining directly into the Atlantic Ocean along the east coast of North America.

Large wall maps are available as part of the U.S. Fish and Wildlife Service's Chesapeake Bay Watershed Activity.

The Patuxent River is Maryland's longest intrastate river (175 kilometers). The watershed of the Patuxent River is completely within the state of Maryland.

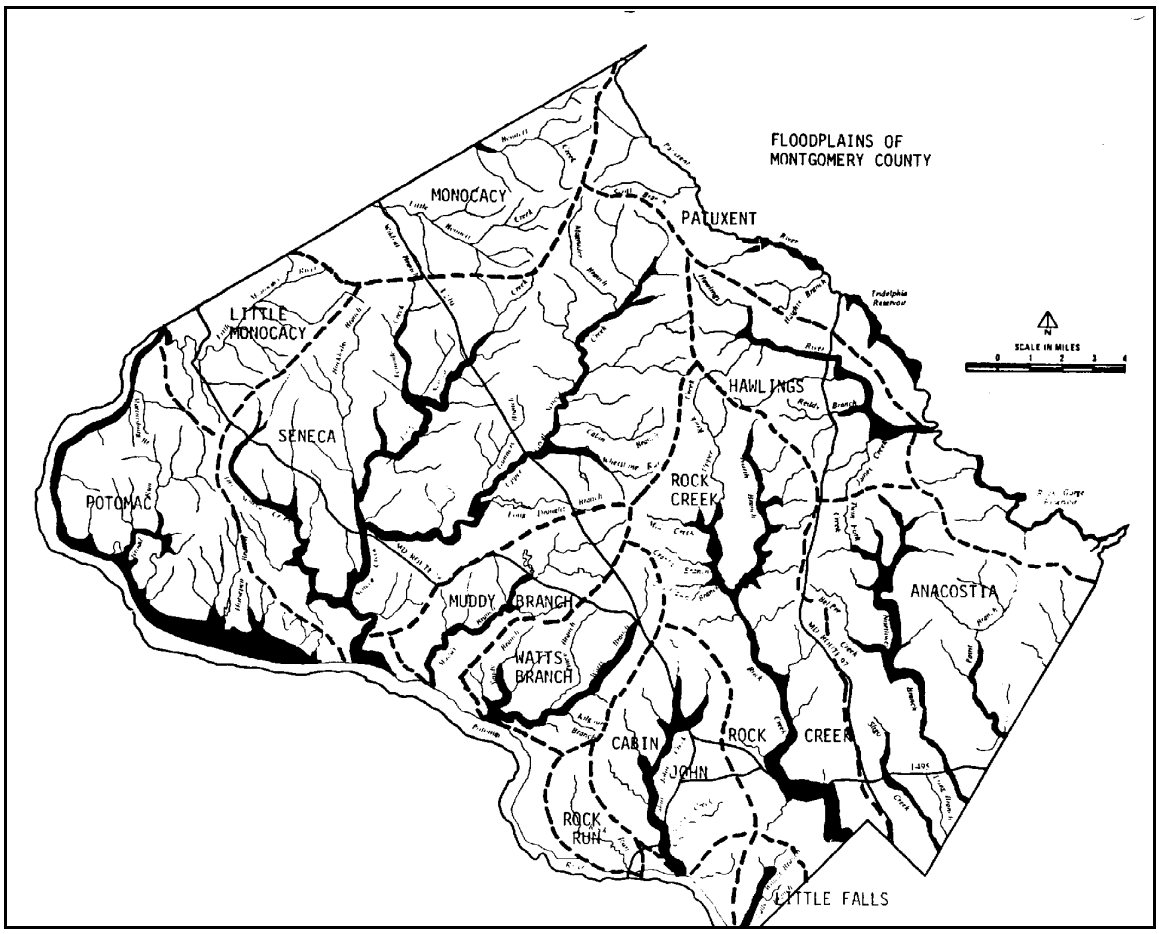
Which counties supply drainage to the Patuxent River?

Approximately how much of Prince George's County drains into the Patuxent?



In Prince George's county, all stream drainage flows into the Patuxent or Potomac Rivers, which then flow into the Chesapeake Bay.

The map below shows the stream drainage in Montgomery County. The various subwatersheds have been outlined and labelled.



Shade in red the area of Montgomery County that drains into the Patuxent River. What is the general direction of stream flow in this area? The western edge of this area locates the drainage divide between the Patuxent and Potomac Rivers.

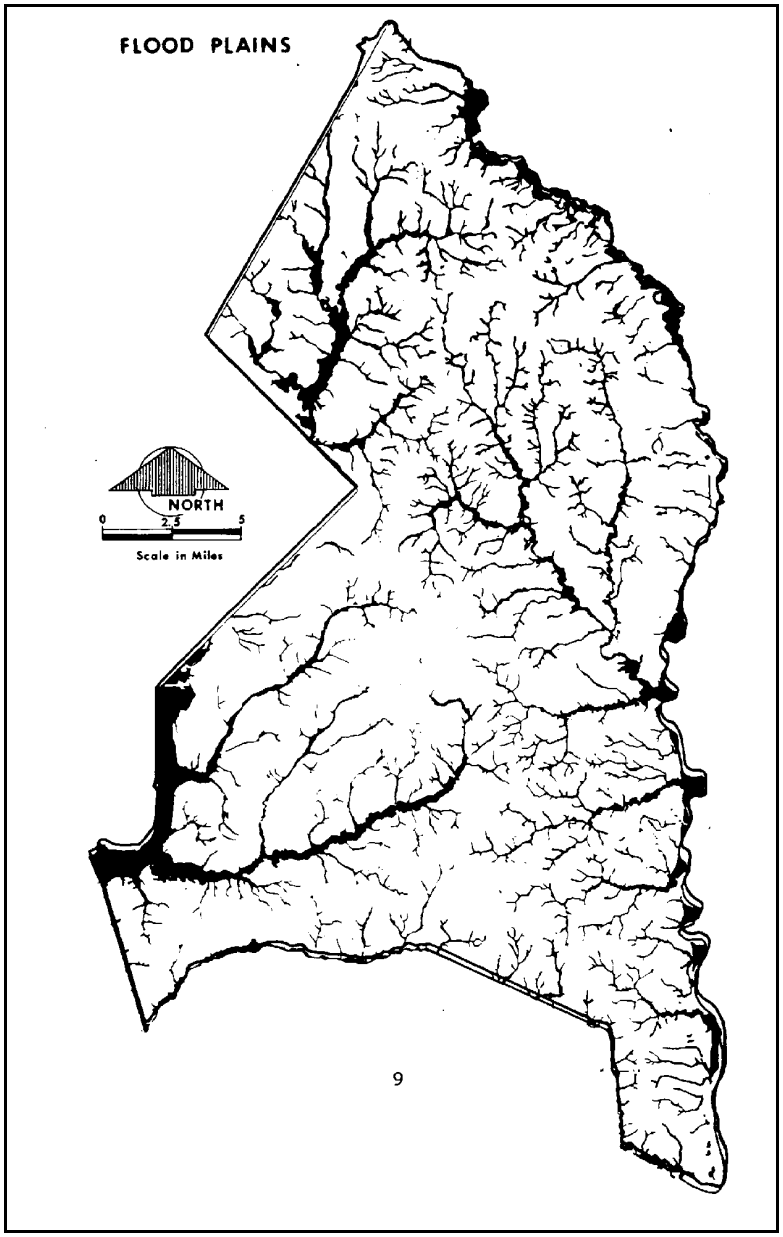
The Monocacy subwatershed eventually drains into the Potomac River. What is the general direction of stream flow in the Monocacy Subwatershed?

Which subwatershed in Montgomery County contributes substantial stream flow into Prince George's County?

The map below shows the drainage in Prince George's County. The floodplain maps can be found in the water and sewage plans for most counties (call your county government offices). Locations and stream names can be found on a county map available form your county Chamber of Commerce.

Locate the drainage divide that separates Patuxent and Potomac watersheds. Draw a dashed line to indicate.

Locate Western Branch, the largest stream draining into the Patuxent River in PG County. Can you find it? Delineate its watershed.



PGCC is located in the Southwest Branch subwatershed of Western Branch which drains into the Patuxent River just south of Upper Marlboro. Can you trace the flow of rainfall falling on campus to the Bay and then the ocean?

storm drains
small stream on northwest corner of campus
Southwest Branch
Western Branch
Patuxent River
Chesapeake Bay
Atlantic ocean

HOW TO GET STARTED AND KEEP YOUR FEET DRY!

There are two organizations that can provide resource information and hands-on activities for streams: Maryland Save Our Streams (800-448-5826), and the Izaak Walton League of America (800-BUG-IWLA). A third source of information and activities is the proceedings of a CREST conference on Chesapeake Bay and Watershed Curriculum Projects (A.M. Beall and S.A. Sinex, editors, PGCC Press, 1994).

The Maryland Save Our Streams (SOS) program produces Be Part of Something Big, a collection of classroom and outdoor activities for 4th-8th graders. The Maryland SOS program, which runs the Adopt-A-Stream program, provides materials free through training workshops. They have a number of prepackaged activities including the Aquatic Life and Stream Quality Sampling Kit.

The Izaak Walton League of America (IWLA) coordinates the national volunteer monitoring program as part of the national Save Our Streams program. IWLA has produced a collection of activities for K-12, Hands-on Save Our Streams ($10). They also provide a number of other materials including an excellent guide to using macroinvertebrates for determining water quality. Most are available for a small fee to recover costs of production.

The Audubon Naturalist Society (301-652-9188) provides training and educational programs on water quality, especially biological monitoring using macroinvertebrates. Montgomery (301-217-6307) and Prince George's (301-883-5850) Counties also have stream team programs in place. If you want to know what is going on in your county, try your county government offices or the Maryland Volunteer Water Quality Monitoring Association (410-377-6270).

THE FIELD EXPERIENCE AND GETTING YOUR FEET WET!

The best activity available for students is going to a stream. The level and length of activities at a stream can be varied to fit the group. The table below gives some suggested topics that can be explored at a stream.

Topic	Activities
water quality	! clarity, color, smell ! macroinvertebrates in bottom sediments ! chemical testing
erosion	! measurement of suspended sediment load ! signs of erosion in stream banks ! erosion control structures
sources of pollution	! refuse or trash found in or near stream ! stormwater pipes (materials carried in from parking lots and streets)
water depth and type of channel sediment	! presence of pools/riffles/runs ! gravel/sand/mud on bottom ! measurement of steam velocity and discharge
monitoring storm changes	! observation of high water and flooding ! changes in water quality especially suspended sediment load
land use in watershed	! near stream bank conditions ! surrounding land uses
maps	! tracing flow path to Chesapeake Bay ! calculating stream gradient ! determining watershed for small stream
vertebrate life	! fish populations ! signs of other animals using stream

Stream activities are best when written for your local stream environment. Take a walk, make some observations, and construct an activity to fit your group of students. The Environmental Protection Agency Region 10 has produced a Streamwalk Manual and accompanying teacher's guide, available by writing to Streamwalk, U.S. EPA Region 10, 1200 Sixth Ave., WD-139, Seattle, WA 98101.

Water quality by chemical analysis and sampling equipment will require some investment. The LaMotte Company (800-344-3100) in Chestertown offers the most reasonable and easiest to operate chemical test kits. The Monitor's Handbook by the LaMotte Staff (cost is $5) offers an excellent introduction to water quality measurements and the stream environment. For sampling equipment, the Tennessee Valley Authority produces two free booklets, Water Quality Sampling Equipment (describes professional equipment for collecting water, plankton, aquatic invertebrates, and fish samples) and Homemade Sampling Equipment (describes how to make low- or no-budget equipment from easily available materials as discussed in the booklet above). These are available by writing to Tennessee Valley Authority, Environmental Education Section, Norris, TN 37828.

Here are fifteen sample questions to consider during a stream activity:

1. Notice the shape of the stream channels as you walk along the stream. Is it straight or curved? Make a simple drawing.

2. What direction is the water flowing? How did you tell?

3. Is the water depth constant or does it change along the channel? Note any deeper water areas on your drawing above.

4. Can you find any deep pools along the channel? How does the water's velocity compare to the shallow parts of the channel? What type of sediment is in the bottom of the pools?

5. Can you find any areas that show evidence of storm or high flow events? How could you tell?

6. Can you find any evidence of pollution in the stream? List any evidence found.

7. Can you find any stormwater outflows (pipes)?

8. Never dispose of waste motor oil or antifreeze into a storm drain. Why?

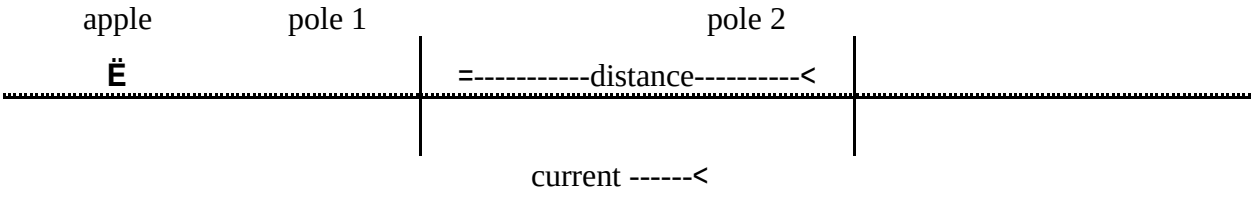
9. Explain why many storm drains are labelled "DO NOT DUMP CHESAPEAKE BAY DRAINAGE."

10. For small streams the largest source of nutrients for the photosynthetic organisms, such as algae, is leaf litter (decaying vegetation). Can you find any? Where did you look?

11. Find an area with a good bend in the channel of the stream. This is called a meander bend. Where does erosion appear to be occurring? Where does deposition appear to be occurring? List the evidence for your choices.

12. Can you find any man-made structures to prevent erosion along the stream?

13. Measure the velocity or speed of the water flowing in the channel. In a straight section of the stream, place the two poles a known distance apart.

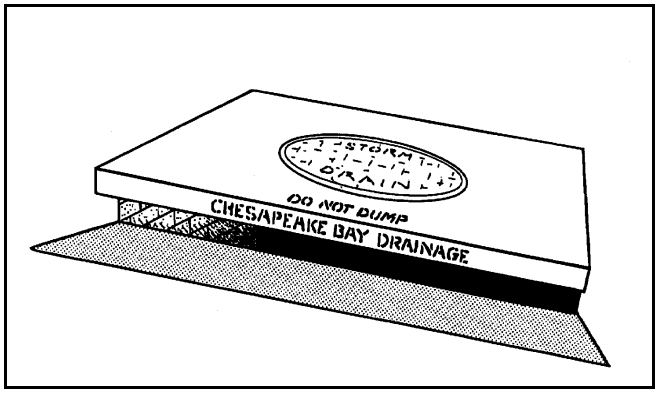


Release an apple (or orange) at a point slightly upstream from pole 1. If the stream is shallow (apple or orange hits bottom) use a cork. Be careful on windy days, the cork can be influenced by the wind! Measure the time it takes for the apple to travel between pole 1 and pole 2. Repeat two more times. Calculate the velocity from distance divided by the average time.

14. Make some observations regarding velocities around a meander bend in the stream. Release two apples (corks) at the same time, one on the inside of the bend and one on the outside. Which apple (cork) traveled the greater distance in a specific amount of time? Can you explain why?

15. Can you relate this (#14) to the erosion and deposition patterns seen earlier?

Hopefully your students will begin to appreciate their backyard stream after an activity of this type. Get them to think of ways they might be contributing to the problems of the Chesapeake Bay. How might they go about finding solutions? The effort of the tributary strategies will need everyone's help. Remember, no matter where you live there is a stream near your backyard! Many of the problems and solutions start with your nearest storm drain.



THE BAY STARTS HERE!