

Activity 1:
Meet the Watersheds

OVERVIEW

Slides and written materials introduce students to the SWEAP watersheds and challenge them to learn more about local land use and water quality.

CONCEPTS

- The local landscape encompasses spatial (from place to place) and temporal (over historic time) differences in ecology and human land use.

MATERIALS

- slide projector
- Introductory Slides of the study sites
- "Meet the Watersheds: An Introductory Slide Show" script
- "Watershed Descriptions & Land Use Histories" handout (one per student)

PROCEDURE

Show the introductory slides to introduce students to the study sites. Read the accompanying script which describes each site and provides some background information about the watersheds' land use histories. Hand out the "Watershed Descriptions & Land Use Histories" information sheets.

Explain that throughout the Small Watershed Ecology Assessment Project students will explore two Challenge Questions:

Challenge Question #1: How is land being used in each of the study watersheds and how has this changed over time?

Challenge Question #2: Do land use activities influence stream water chemistry, the amount of water flowing through the stream, and the types of organisms that live in it?

MEET THE WATERSHEDS

An Introductory Slide Show

Arlington School District

Slide 1: A watershed is the land area that drains into a body of water. It's also called a drainage basin. Some of the water that falls within the watershed as rain, sleet or snow will evaporate or be used by plants. The rest will move across the land surface or percolate through the soil until it reaches a body of water.

Some watersheds are very large. The Hudson River watershed, for example, is approximately 13,400 square miles. Others are very small. The watershed that drains into the stream shown in this picture is approximately 0.2 square miles, or 125 acres.

Slide 2: This watershed, shown here in late November, is one of three small watersheds that we will study as part of the Small Watershed Ecology Assessment Project. All three watersheds are located near Arlington High School. All three watersheds are drained by small streams.

Slide 3: However, human activities in the three small watersheds are very different. This is a photo of watershed #1 in January. The upper portion of the watershed is part of the Taconic-Hereford Multiple Use Area, a steep and forested region where human activities are restricted to hiking, bike riding, and hunting. Deer, squirrels, birds and other animals are abundant here.

Slide 4: The small stream flowing through this watershed supports a high diversity of organisms, and water quality tests indicate clean water.

Slide 5: Further downstream below our sampling location the stream has been cut through by a utility right-of-way and the underground Iroquois natural gas pipeline. The stream also passes under driveways leading to houses perched on the upper slopes of the watershed.

Slide 6: The main stream channel was heavily disturbed by construction of the pipeline so the stream meanders in confusion through this area. A second convenient stream sampling location lies downstream from the pipeline. Do you think the stream's water quality is different above and below the pipeline?

Slide 7: This is part of watershed #2. Karl Ehmer, a local farmer, used to own most of the land within the watershed boundaries. Until the property was sold in 1987, he grazed cattle and grew corn on the land.

Slide 8: Now there is a small horse farm on the property, and the rest of the land is regenerating with berry bushes and meadow grasses.

Slide 9: There is a small stream draining the watershed. It flows into two old holding ponds that were used by Karl Ehmer as watering holes for his cattle. Now the ponds collect manure from a nearby horse paddock. After the stream flows out of the holding ponds it runs south until it merges with Sprout Creek.

Slide 10: This is part of watershed #3. Within the boundaries of this watershed lie several residential neighborhoods, a portion of route 55, many commercial offices and warehouses, and a large expanse of paved parking lot like the section that you see in this photo.

Slide 11: Many human activities in this watershed generate nonpoint source pollution, or pollution that comes from numerous and diffuse sources. Road salts applied on roads and parking lots in the wintertime wash into the stream and increase chloride levels in the water.

Slide 12: Construction within the watershed has contributed to erosion, filling the stream with sediments and debris. Homes and businesses may contribute to pollution in the stream by using too much fertilizer on lawns, by dumping substances like paint and motor oil into storm drains, and by using phosphate-rich detergents. Leaky septic systems may introduce nitrates and phosphates into the nearby stream.

Slide 13: The stream in watershed #3 also has significant quantities of solid waste in it, like soda cans, paper cups and this chair.

Slide 14: The stream channel itself has been heavily manipulated: dredged in several places to create small ornamental ponds, re-directed during construction of warehouse buildings, and sent underground through enormous metal culverts. This can affect both the quality and quantity of the stream water.

Slide 15: Now you have had a brief glimpse of the three study watersheds. You have seen how land use within their boundaries ranges from healthy forest in the upper portions of watershed #1 to heavy commercial development in watershed #3 shown here. Your challenge in the Small Watershed Ecology Assessment Project is to answer the following questions:

- How is land "used" -- or covered by roads, buildings, and vegetation -- in each of the study watersheds, and how was land used in the past?
- Does land use influence stream water chemistry, the amount of water flowing through the stream, and the types of organisms that live in it?

Good luck!

Watershed Descriptions & Land Use Histories ***Arlington School District***

WATERSHED #1: Downing Road (forest)

This forested watershed includes portions of the Taconic-Hereford Multiple Use Area and sections of privately-owned, undeveloped property used by members of the Crum Elbow Sportsmen's Association. Abundant populations of deer, squirrels, rabbits, and other small game live in the area. In the upper portion of the watershed, only the old stone foundations of several farm houses indicate human presence. These homesteads have been abandoned for many years but remain as lingering clues to past farming and logging activities.

The small stream that flows through this forested watershed is a tributary to Sprout Creek. After leaving the Crum Elbow Sportsmen's Association's property, the stream flows steeply downhill beside Downing Road. It passes through a sparse residential area and crosses a utility right-of-way and the Iroquois natural gas pipeline. To determine if the human activities associated with roads, residences, and underground pipelines have an effect on the stream's water quality, you may wish to revisit it downstream at the junction of Gidley and Downing Roads.

WATERSHED #2: Budd Lane (old field & horse farms)

The land cover in this small watershed consists predominantly of old fields, evidence of a rich and lengthy agricultural history. Until recently, Karl Ehmer owned most of the land in the watershed. He grazed cattle and grew corn on the property. When the farm was sold in 1987 agricultural activities stopped and early successional plant species like green briar and multiflora rose began to grow in the abandoned fields.

The land north of Alley Road was used as sheep pasture for many years by the Alley family. They operated a feed and grain store down the road adjacent to a family-owned cheese-making operation. Within the past several decades, the farms and agricultural businesses have become suburban residences, a typical trend for this part of Dutchess County.

The stream that flows through this watershed originates in a wetland area so it flows all year instead of drying up in the hot summer months. Near the sampling site the stream passes through two holding ponds. The ponds were dug by Karl Ehmer as watering ponds for his cattle. The current property owners operate a horse boarding facility and carriage riding center. Their paddock extends within 25 feet of the water's edge, so manure flows directly into the pond following heavy rains.

An upscale housing development was recently proposed for a 240-acre parcel of land that cuts through the watershed, so land use within the watershed may change in the near future.

WATERSHED #3: Noxon Road (commercial/residential)

Watershed #3 has been heavily developed into residential neighborhoods, roadways, and a business park. The stream that drains the watershed has been rerouted several times along its length during the construction of parking lots, buildings, and roads. The stream begins as the outflow of an artificially-constructed pond in a housing development on the north side of route 55. A large metal culvert carries the stream under route 55, through another housing development, and into another residential pond. The family that owns the pond used to swim in it fifteen years ago, but now the pond is much shallower and it turns bright, slimy green with algae in the summertime. The pond can be viewed at the intersection of Meier Road and Donnie Place.

After flowing out of the pond through a spill pipe, the stream passes through a construction site where workers have erected a culvert and hay bales to prevent additional erosion of topsoil into the stream water.

Next the stream gains size with the addition of storm water runoff from a huge expanse of pavement at the Freedom Executive Park where companies like United Parcel Service, Merchant's Press Incorporated, DMS, and the Department of Transportation have office and warehouse space. Near the sampling site by Noxon Road the stream is littered with visible evidence of its urban surroundings: soda cans, shopping carts, and paper trash line its banks. Pungent odors of decay emanate from the silty, algae-covered stream. Ultimately the stream empties into the Wappinger Creek.

Activity 2:
A Research Request

OVERVIEW

Students form Research Teams and receive a research request from the Institute of Ecosystem Studies and from local landowners who live within the boundaries of the SWEAP watersheds.

MATERIALS

- "Memorandum #1" handout (one per student)

PROCEDURE

Divide your class into groups of 3-5 students. Give each student a copy of the handout titled "Memorandum #1." Read the research request aloud. Explain that each group is a SWEAP Research Team that will work together to gather comparative information about the study watersheds. Their final assignment (described in Activity 14) will be to produce a report summarizing and presenting what they have learned about the three study streams (or ponds) and their watersheds.

NOTE: Many of the local landowners who have given students permission to investigate a stream or pond on their property are very interested in the students' studies. Several are willing to send your class a research request letter asking students to study their stream and its surrounding watershed and then to prepare a report of their findings. You are encouraged to contact one or all three of the landowners in your school district to solicit such a letter. These could replace "Memorandum #1" as a way to introduce and structure the SWEAP investigations.

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MEMORANDUM

To: SWEAP Research Teams
From: Dr. Alan R. Berkowitz, Head of Education
Subject: A Research Request
Date: January 10, 1996

The scientists at the Institute of Ecosystem Studies (IES) are very concerned about the quality of the natural waters of Dutchess County. Clean water is important not just for the people who might be drinking the water downstream, but also to sustain healthy aquatic ecosystems. While point sources of pollution to ponds, lakes, streams and rivers are obviously important and deserving of attention, we've come to understand that the way land is used throughout a watershed also can affect its water quality.

You are invited to participate in a study of the relationship between land use and water quality in three small watersheds near your school. By carefully comparing the streams or ponds themselves, and the land areas that feed water to them, you can help answer the question, *What land use and other features of a drainage basin lead to the highest quality of water leaving a watershed?*

In order to address this big question, you will have to answer a number of smaller ones: *How are the three watersheds similar and how do they differ? How does the water quality—chemical and biological—compare in the three streams or ponds? What evidence can you find for a relationship between specific things happening on the land and aspects of water quality?*

The scientists here at IES and the landowners whose land you will be studying when you visit the watersheds are very interested in your findings. When you have completed your studies, please prepare a research report, distributing copies to me, to the local landowners and to your school's Watershed Data Bank. I will send more details soon.

Thank you for considering this request, and good luck!

Activity 3:
Water In a Watershed

OVERVIEW

Students watch a simple demonstration and learn about watersheds, runoff and pollution.

CONCEPTS

- A watershed (or drainage basin) is the area of land that contributes water to a stream or pond.
- The flow of runoff and seepage in a watershed is directed by ridges -- the high points that separate adjacent watersheds.
- Everyone lives in a watershed.
- Land use activities in a watershed can affect water quality and quantity.

MATERIALS

- shallow basin or tub
- several sheets of newspaper
- white plastic garbage bag
- spray bottle or atomizer
- food coloring
- one piece of paper towel
- Reading 1: What's A Watershed? (one per student)

PROCEDURE

Create a simple watershed model by crumpling up several pieces of newspaper and placing them in the bottom of the basin. Cover the newspaper with plastic: this is the land surface. The uneven distribution of the paper should create a raised relief map with hills and valleys. Ask students what will happen to rain falling on the land surface. Where will it go? Where will it end up? Spray water on the plastic to test their predictions. (The water will be easier to observe if you add a little food coloring.) The water will flow from high points to low points in rivulets that represent streams and rivers and will collect in pools that represent lakes or the ocean. Explain that the area draining into each stream, river, or lake is called a watershed. Notice that every location on the plastic is part of a watershed.

Use a tiny piece of paper towel soaked in food coloring to represent a source of contamination like motor oil or lawn fertilizer or a leaky septic system. (Make sure you use a different color of food dye this time.) Ask students to predict what will happen to the contamination when it rains. Place the dyed piece of paper towel on the plastic watershed model and spray to make it rain. Watch as the "pollutant" flows into a stream and then into a nearby lake or ocean. Also notice that only one "watershed" is polluted unless the pollutant is on a divide.

Give students a copy of Reading 1: What's A Watershed? for background information.