Small Watershed Ecology Assessment Project

Arlington School District Version

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Summary

Welcome to SWEAP, the Small Watershed Ecology Assessment Project. Prepared by staff of the Education Program at the Institute of Ecosystem Studies, SWEAP introduces middle and high school students to their local land and water environments. The SWEAP materials and activities assist teachers in guiding their students as they compare the ecology of three small watersheds with different land uses (e.g., agricultural, forested, developed). Students learn about the factors that determine the quantity and quality of water flowing from any watershed, and the impact this has on aquatic ecosystems. The project also includes a strong emphasis on local land use history and the impacts people have had on the natural world. Thus, the materials contribute to the new state education requirements for teaching science with a problem-solving, community-based approach.

The four school districts in the project serve students in communities crossed by the Iroquois natural gas pipeline (Arlington, Dover, Hyde Park and Millbrook), which was a condition of the grant obtained from Iroquois' Land Preservation and Enhancement Program. It is hoped that the project will ultimately reach beyond Dutchess County and provide a model for other teachers, environmental education centers, or community members interested in watershed ecology education. The materials are flexible and will support teachers in conducting anywhere from a single exercise to an entire 2-3 week study of watersheds.

Why Water is Important

When viewed from space, the earth looks more like a liquid planet than a solid one -- water covers nearly three-fourths of the earth's surface. Water also makes up over 70% of the human body and is critical to the survival of all organisms on earth. We drink it, wash with it, irrigate crops with it, and sail on it. The average American uses between 80 and 100 gallons of water each day. A large percentage of the world's protein, in the form of fish and shellfish, comes from oceans, lakes and rivers. Water ultimately affects climate, too -- not only rainfall and snow, but temperature and winds as well.

Dutchess County's water resources are abundant and diverse. The County boasts more than 800 miles of streams and numerous lakes and ponds, 93 of which have been named while dozens more remain unnamed. The SWEAP materials concentrate on a small subset of these water resources in a manner which encourages comparison and intense study.

The Ecology of Small Watersheds

Watersheds, the land area draining into a single body of water, can be considered a basic unit of the landscape that determines water availability, movement, and quality. When students study watersheds, they learn in a personal way about the importance of water, and how land use affects surface and groundwater. The SWEAP watersheds are small enough to be reconnoitered through fairly simple work with maps and air photos, and they can be explored quickly in the field. Since the study watersheds were chosen with distinctly different land cover types, comparisons of water quality and stream ecology can be related directly to differences in land use.

The SWEAP Challenge

The SWEAP materials and the fourteen suggested activities presented here are designed to guide students in a comparative study of their three small watersheds. Students are challenged to address two broad 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?

The SWEAP Materials

Each SWEAP school district has three watersheds to study, chosen for a few simple characteristics. The watersheds comprise fewer than 500 acres in area and drain through a single-source stream or a pond. All but one of the streams flow year-round. Landowners have given their permission for students to explore each watershed and collect samples. The watersheds are reasonably close to the schools and have suitable sites for school bus parking.

The SWEAP materials for each school district include the following:

1) Introductory slides of the watersheds taken during various seasons, plus an accompanying script that identifies and explains each slide.

2) A simplified road map showing the most direct route from the school to the study watersheds.

3) A class set (10 total) of laminated color topographic maps (1" = 2,000') showing all three watersheds, the full length of the streams that drain them, the location of each sampling site, and the approximate boundaries of each watershed.

4) A class set (10 total) of enlarged, laminated color topographic maps (1" = 1,000') centered on each watershed showing the stream or pond and the approximate watershed boundaries.

5) A set of enlarged, laminated color topographic maps (1" = 1,000') centered on each watershed showing the stream or pond and the sampling site, but with no watershed boundaries marked.

6) Laminated aerial photographs (1" = 400') from 1970 and 1990 centered on each watershed, with the stream or pond and watershed boundaries marked.

7) A class set (4 total) of soil maps (1" = 2,000') showing all three watersheds, with the stream or pond and watershed boundaries marked, accompanied by a simplified key to the soil types.

8) Descriptions and Land Use Histories: A history of land use activities within each watershed, based on interviews with current land owners and tax map data. Supporting natural history information about bedrock type and depth, nearby wetlands, stream volume, and special geologic features is also included. This information is intended for use by the students as they study the watersheds.

9) Access Information: Detailed descriptions of access to the stream or pond and, if possible, to parts or all of the surrounding watershed, including land ownership, contact names and numbers, and type of permission required. This information is intended for use by teachers as they plan their field trips to the watersheds.

10) Baseline data on water chemistry and aquatic organisms for comparisons of the three stream- or pond-sampling sites.

The Activities

The watershed topic embraces a rich diversity of concepts and skills, so the SWEAP materials can be integrated into school curricula in many different ways. The fourteen suggested activities presented here are organized into six modules that introduce students to their three study watersheds, assist students as they explore key watershed concepts, help students develop scientific skills of inquiry and observation, and guide students as they compare their three study watersheds. Some of the classroom activities include developing map-reading skills and learning to delineate watershed boundaries, learning basic techniques of water quality determination, identifying historical trends in local land use, and devising a food web for their study sites. Many of the activities include student worksheets for use in the classroom. Worksheet answer keys can be found at the back of the SWEAP manual.

Following the modules is a collection of readings. This section gives detailed explanations and provides additional examples of many of the concepts explored in the SWEAP activities. These readings give the teacher background on the concepts to be explicated in the activities and can be reproduced as student handouts to augment student understanding.

A glossary at the end of the manual provides definitions of many of the terms used in the modules. The SWEAP manual also contains a list of water curricula and resources that teachers may find of additional aid in developing their field and classroom activities.

The Watersheds

- Arlilngton: The three study watersheds in the Arlington School District are dominated by dramatically different land use activities. One is forested, one has horse farms and old fields now out of cultivation, and one is undergoing residential and commercial development. The watersheds demonstrate a common trend within this district: the abandonment of old agricultural land and development of commercial plazas and suburban housing.

- Dover: Dover hydrology is dominated by major water bodies like the Swamp River and the Ten Mile River which drain enormous watersheds well beyond the scope of SWEAP. The three small watersheds that were selected in Dover are all forested. However, the quantity of water flowing through the three drainage streams differs dramatically. One watershed is dominated by steep, rocky slopes. The thin soil has little water holding capacity so the stream flows vigorously following precipitation events and then dries up during dry periods. The second watershed contains a large wetland area which ensures a steady water supply for the stream. The third watershed has no wetland area but is roughly twice as large as the other two. Its small drainage stream flows steadily all year.

- Hyde Park: The study sites in the Hyde Park School District are ponds. One is a reservoir in a forested watershed that supplies water for a small local community. One pond sits in the middle of a residential neighborhood. The third is the largest human-made water body in Dutchess County and receives runoff from areas of agriculture and livestock grazing as well as forest and residences. These three ponds reflect a spectrum of human impacts.

- Millbrook: Two small watersheds were chosen in the Millbrook School District. One is forested and the other supports a range of land use activities from residential housing and major roadways to agriculture. The third study site is the Mill Brook near the Village of Millbrook Water Treatment Plant where students can look for evidence of point source pollution resulting from the water treatment plant's effluent.

Further Information

We encourage interested individuals or organizations to contact us for additional information about the Small Watershed Ecology Assessment Project:

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