

# Stream Monitoring and Education Program

## UPPER THAMES RIVER CONSERVATION AUTHORITY

### GRADE 7 AND 8 PROGRAM

#### Overall Goals:

- < To teach students monitoring techniques and how monitoring information relates to management and enhancement work.
- < To instill in students a sense of stewardship for their local watershed through involving them directly in project activities.
- < To collect valuable data on the study watershed.





The program is divided in four components:

**INTRODUCTION!**

**INVESTIGATION!**

**MONITORING!**

**ACTION!**

	Location	Delivered By:
<hr/>		
 <b>INTRODUCTION!</b>		
Our Watershed Project	Classroom	Teacher
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 <b>INVESTIGATION!</b>		
Our Watershed, Our Community	Classroom	Teacher
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 <b>MONITORING!</b>		
Invertebrate Experts / Adopt-an-Invertebrate	Classroom	Teacher
Benthic Invertebrate Monitoring	Field	UTRCA
Habitat Quality Assessment	Field	UTRCA
The Big Picture	Classroom	UTRCA
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 <b>ACTION!</b>		
Seeing It Differently	Classroom	UTRCA
Student Reports	Classroom	Teacher
Spreading the Word	Classroom	Teacher
Helping Hands	Field	UTRCA
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The program takes place throughout the school year, with the field sessions in October/November and April/May. The components are designed to be done in the order listed.

This program is a product of the Cedar Creek Watershed Project Stream Health Monitoring and Education Program that has been implemented since 1997 in Oxford County, Ontario. Some activities have been adapted from the several watershed monitoring program books available. The teachers participating in the program for the first two years contributed significantly by sharing classroom lessons they used and providing feedback on activities that were done.

A list of resources used in developing this program is included at the end of this program guide.



# Introduction

**Objective:** To introduce students to the Watershed Project.  
To excite the students about participating in an environmental project in their own community.

**Key Words:** watershed, monitoring

**Activity:** Our Watershed Project

## Our Watershed Project

In September, students are given a brief overview of the Watershed Project and an explanation of the important roles they are playing in protecting and enhancing an ecosystem in their own community.

**Materials:** Watershed Project Factsheets  
State of the Thames River Watershed poster  
*The Streamkeeper* video starring Bill Nye the Science Guy

- < 25 minutes
- < This video was produced by the Adopt-a-Stream Foundation in Washington State. It is a great video for introducing students to the other components of the program. It also explains the watershed concept, monitoring, and sources of pollution.
- < The UTRCA has one copy of this video that teachers can borrow.



# Investigation!

**Objectives:** To introduce students to their local watershed.  
To teach students basic mapping reading skills using maps of their local area.

**Key Words:** watershed, watercourse, tributary, headwaters, wetland, meander, upstream, downstream, current, pond, wetland, contour line, air photography

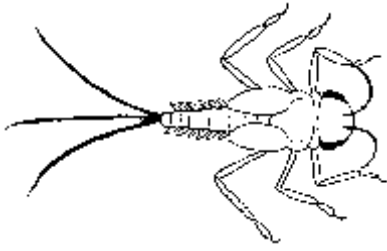
**Activity:** Our Watershed, Our Community

## Our Watershed, Our Community

Students are introduced to their study watershed through various activities. Maps for the watershed and activity sheets are included in the program package.

- Materials:**
- One set of 1:10000 Ontario Base Maps for study watershed per school (laminated)
  - One set of 1:10000 original maps for Modeling a Real Watershed to photocopy
  - One set of 1:5000 Air Photo Maps for study watershed per school
  - SPLASH! Video (The UTRCA has copies of this video that teachers can borrow.)
  - Making a Topographic Map (from *Watershed Science for Educators*)
    - < Students draw a 2-dimensional map from a 3-dimensional model
  - Modeling a Real Watershed (from *Watershed Science for Educators*)
    - < Students make a 3-dimensional model from a 2-dimensional map.
    - < Map sheets are provided to photocopy for this activity. Each student or pair of students builds their own map and the entire class puts their maps together to create a giant relief map of the study subwatershed.
  - Drawing Your Watershed Boundaries (from *Watershed Science for Educators*)
    - < Students determine where watershed boundaries are using the 1:10000 laminated maps. Each student or group will need to pick a subwatershed of the study watershed for this exercise (due to the scale of the maps). The activity can be checked by comparing their watershed lines to the relief map from the previous exercise.
    - < This exercise can be done at the watershed level if the school has 1:50000 topographic maps.
  - Your Watershed (from *Watershed Science for Educators*)
    - < Using the relief map, laminated 1:10000 maps, and air photos, students can answer questions about their watershed on the worksheet.
  - Map Symbols, Colors, and Patterns (from *Watershed Science for Educators*)
    - < This is an additional worksheet that can be used with Your Watershed above.

As a conclusion to the mapping exercises, students discuss what information about the watershed that they cannot see on the maps. They make a list of 8-16 questions to ask the landowner at their site on the field day. (Check with the UTRCA about the availability of the landowner on the field day.)



# Monitoring!

**Objectives:** To introduce students to stream assessment techniques and the types of organisms found in a stream ecosystem.  
To collect valuable data about the watershed.  
To teach students about the relationships between different stream animals and plants and the surrounding land.

**Key words:** benthic, invertebrate, indicator species, d-frame net, streambank, habitat, dissolved oxygen, pH, turbidity, riffle, pool, run, flat, diversity, pollution, erosion, larva, nymph, producer, consumer

**Activities:** Invertebrate Experts / Adopt-an-Invertebrate  
Benthic Invertebrate (Stream Health) Monitoring  
Habitat Quality Assessment  
The Big Picture

## **Invertebrate Experts / Adopt-an-Invertebrate**

(adapted from a North Norwich School class program and from "Bird File" in *BirdQuest*)

It is important for the students to recognize the types of invertebrates they may see in the field. It is difficult in a two-hour field session to teach them all the different types. There are pictures of each type on the datasheet with identifying features so they do not need to be experts on every invertebrate. A series of invertebrate "briefs" is provided and these can be copied onto overhead sheets to present to the class.

Each student or a group of students completes a short project on one of the types of invertebrates. Their projects could cover the invertebrate's life cycle, identifying features, feeding habits, and habitat. A good source for information is insect field guides and invertebrate or entomology books.

Students can make a file reference card for their invertebrate. (Recipe cards would work well.) The card would include a picture (hand-drawn or cutout) and the information on the invertebrate. The cards could be organized into a class reference drawer or in a display showing food web interactions, a "family tree" showing taxonomic relationships, or a chart of pollution tolerance.

Classes should organize their 8 monitoring groups before the field trip so there is a good mix of "experts" from each of the pollution tolerance categories in each student group.

**Materials:** Common Invertebrates Overhead Originals

## Benthic Invertebrate Monitoring

When the students arrive at the site, they are organized into 8 groups (or they can be organized in the classroom before the trip). The group chooses one person to be the recorder. He or she gets a clipboard with a Benthic invertebrate Monitoring datasheet. A pencil is supplied with the clipboard. Pen is not used on the datasheets because it runs when it gets wet.

The students are asked the following questions:

What is an invertebrate?

- < animals without backbones or internal skeletons - e.g., insects, snails
- < bug is not an appropriate word because it refers to a group of invertebrates - terms we can use: critters, creatures, organisms, inverts

What does benthic mean?

- < on the bottom of a water body, e.g., in the mud and gravel

What does an animal need to survive?

- < Food        invertebrates eat a variety of things: algae, plant material, dead matter, other invertebrates
- < Shelter     live under rocks, in the mud and in vegetation to hide from predators or so they won't be swept away
- < Oxygen     pollution reduces oxygen in a stream because bacteria and algae use up oxygen in the water and some invertebrates require high oxygen  
riffle areas are important because oxygen is incorporated into the water

Each group finds a space on the tarp and gets the following equipment: plastic tray, magnifying cubes and/or yogurt cups, and small squares of window screen.

A D-frame net is used to sample the stream. It is flat on one side to lay flat on the bottom (benthos) of the stream. Students collect the sample by kicking up the top 2-5 centimetres of gravel and sand from a riffle area into the net. It is important to start at the downstream end of the site and work upstream so subsequent samples are taken from undisturbed areas. The net, filled about half full, is swished around in the water to get rid of sand and fine silt. It is turned upside down in a water-filled plastic tray and rinsed.

All the students in the group sit around the tray and look for invertebrates swimming in the water and crawling on the sand and gravel. Invertebrates are scooped up with the squares of window screen and put into the magnifying cubes and yogurt cups partially filled with water. Each type of invertebrate can be kept in a separate container to make it easier to keep tallies. The recorder keeps track on the datasheet of the invertebrates collected.

Mayflies, caddisflies, and stoneflies from all groups are put into the larger white dishes. At the end of the benthic monitoring session, the class determines the EPT value by counting the numbers of types of mayflies, caddisflies, and stoneflies.

The yogurt cups and magnifying cubes are emptied into the plastic tray, and the trays are poured back into the creek and rinsed out. The students complete their tallies and hand their datasheet into the group leader. It is explained that the sheets will be returned at the in-class session.

Materials:     Stream Health Assessment form  
                  EPT Value form

## Habitat Quality Assessment

Students determine the wildlife habitat quality of the stream at their site. There are two parts to this activity: the landowner interview and the habitat quality assessment.

### Landowner Interview

Depending on the availability of the landowner on the field day, students ask questions about the history and land use at the site. The purpose of the interview session is to provide an opportunity for students to discover information that may not be apparent by just looking around or through the monitoring.

Students will prepare eight to sixteen questions (1 or 2 per group) in class before arriving at the site. All recorders should write down the answers to all of the questions or they should be shared when students return to class. Questions can cover land use, local history, or landowner's opinions. Students may also use the answers to the landowner questions on their habitat quality assessment forms.

### The Assessment

The students will be asked the following questions:

What does habitat mean?

< the place where an organism lives

What makes a good habitat?

< has all the things that the organism needs - food, shelter, water, mates

The students assess the habitat quality by doing several tests. They continue to work in the same groups. The recorder has a clipboard with a Habitat Quality Assessment form that is filled out as the tests are completed. Each group also has a booklet explaining all the tests and what they mean. The first two tests are done as a entire class (dissolved oxygen and pH) and the remaining tests are explained. The leader explains how each test is done, where the tests should be done (the area will be flagged), and how to fill out the datasheet. The groups work independently doing the tests in the order that they appear on the datasheet and booklet. This is important so the results of the Turbidity and Wildlife tests are not affected by students being in the stream and trampling the streambanks. The leader encourages the students to ask questions if they are unsure of the meaning of a test, how it is to be done, or a result.

Each group is also given a garbage bag to collect any trash they find in or around the stream.

Groups are encouraged to take good notes as they will be writing a report on the monitoring. Datasheets are turned in to the group leader at the end of the session, with an explanation that they will be returned at the in-class session.

The following games may be played at the end of the field session, if there is time:

Who am I?

The Thicket Game (Project Wild)

You Name It (p. 51 Science Is)

Ecosystem Tag (p. 158 Science Is)

Materials:     Habitat Quality Assessment Form  
                  Habitat Quality Assessment Instructions for Students booklet

## The Big Picture

Stream Health Assessment and Habitat Quality Assessment Forms are returned and students calculate their scores. They determine the Stream Health Assessment Score for their class' site and compare their site to other sites by colouring a map of the watershed.

Looking at their map, the students answer the following questions on the back of the map and hand it in to the teacher:

1. Where are the healthiest sites in the watershed? Where are the sites with the poorest health?
2. What could be causing the poor health at these sites? Use Habitat Quality Assessment results to help answer this question.
3. How has the health changed over time? (If this is not the first session of monitoring)
4. If the health has changed, what may have caused it?

Materials: Stream Health Monitoring Results Map for Students



# Action!

**Objectives:** To involve students in reporting the results of the monitoring to the community and in suggesting ways to improve the health of the watershed.  
To demonstrate that there are many different ways of looking at objects or situations and all perspectives are important and need to be taken into consideration when decisions are made.  
To improve the health of the watershed by involving students in enhancement work.

**Key Words:** perspective, purpose, methods and materials, results, habitat enhancement, bioengineering, naturalization

**Activities:** Seeing It Differently  
Student Reports  
Spreading the Word  
Helping Hands

## Seeing It Differently

(from "It Depends on How You Look at it" Activity #2, p. 47 Science Is)

Pass around an object. As each person receives the object to examine, he or she must describe it in one or two sentences. Each person must describe the object different from the person before him or her. Some people might look at the object from different angles. Others might talk about its colour, shape, smell, taste, texture, or sound. Yet others might describe the object's role in the world or how it might feel if it had feelings.

To improve the health of the watershed, all opinions and perspectives need to be taken into consideration. The students are asked whose perspectives should be considered when making decisions about any habitat improvement in the watershed.

## Student Reports

Students write reports about the monitoring project. Length and content is at the teacher's discretion. It can be in essay format or written as a scientific report that includes purpose, methods and materials, results, and discussion. However, all reports should make recommendations about how to improve the stream health at the class' site or anywhere in the watershed. Students should keep the perspectives of others in mind when making recommendations. For example, planting trees on *all* the agricultural land in the watershed is not a feasible option. The teacher will decide whose report will be posted on the project web site. Reports for the web site need to be in paragraph form and submitted on disk or via email.

## Spreading the Word

Students brainstorm ideas on how they can communicate their results to the community. This can be incorporated into the student report or done as a separate activity. If the students implement any of their communications plans, please notify or send articles to the UTRCA. This helps staff to be prepared to answer questions from people who may call as a result of the communication. The UTRCA also keeps a file of all communications about the project.

The UTRCA contacts the media before the monitoring field trips.

## Helping Hands

Enhancement projects are being planned throughout the project area. The UTRCA tries to involve all classes in enhancement projects, but projects are dependent on site availability (and suitability) and funding. Several projects are possible and background information is enclosed in this program package on some of the projects. They include

- < bioengineering
- < tree planting (UTRCA Community Forestry program)
- < in-stream blockage and garbage cleanouts
- < riffle building
- < nest box building

The UTRCA has two bioengineering videos, “Bioengineering... In Action” and “Managing Agricultural Drains to Accommodate Wildlife” that can be borrowed by teachers.

Classes may raise money for enhancement projects. The UTRCA works with the school to decide on an enhancement project that fits the school’s interest and the amount of money the school expects to raise.

Materials:      Community Forestry brochure and Teacher’s Package  
                      Bioengineering...In Action Teacher’s Package  
                      Managing Agricultural Drains to Accommodate Wildlife

# Glossary

adult	<ul style="list-style-type: none"><li>• the final developmental stage of an insect</li><li>• able to produce eggs</li></ul>
bioengineering	<ul style="list-style-type: none"><li>• a general term for streambank stabilization and erosion control methods that use natural vegetation</li></ul>
carnivore	<ul style="list-style-type: none"><li>• animals that eat only other animals</li></ul>
community	<ul style="list-style-type: none"><li>• the different species living in a defined area</li></ul>
consumer	<ul style="list-style-type: none"><li>• organisms that cannot make its own food</li><li>• feeds on other organisms</li></ul>
decomposer	<ul style="list-style-type: none"><li>• organisms that break down plant and animal matter</li></ul>
downstream	<ul style="list-style-type: none"><li>• in the direction of water flow</li></ul>
erosion	<ul style="list-style-type: none"><li>• wearing away of the land surface by water or wind</li></ul>
extinction	<ul style="list-style-type: none"><li>• the loss of a species on Earth</li></ul>
floodplain	<ul style="list-style-type: none"><li>• the area next to a watercourse that becomes flooded during times of high water</li></ul>
food web	<ul style="list-style-type: none"><li>• the feeding relationships between many different organisms in a community</li></ul>
habitat	<ul style="list-style-type: none"><li>• the physical area where an organism lives</li></ul>
headwaters	<ul style="list-style-type: none"><li>• the beginning of a watercourse (1<sup>st</sup> order stream)</li></ul>
herbivore	<ul style="list-style-type: none"><li>• animals that eat only plants</li><li>• also called a primary consumer</li></ul>
indicator species	<ul style="list-style-type: none"><li>• an organism whose presence (or absence) indicates how healthy a community is</li></ul>
invertebrate	<ul style="list-style-type: none"><li>• animals without a backbone or internal skeleton</li></ul>
larva	<ul style="list-style-type: none"><li>• the developmental stage of an insect between egg and pupa</li></ul>
meander	<ul style="list-style-type: none"><li>• a series of loops and bends that a watercourse travels</li></ul>
mouth of a waterway	<ul style="list-style-type: none"><li>• the point at which a river empties into another body of water</li></ul>
natural area	<ul style="list-style-type: none"><li>• wetlands, meadows, forests, valleylands, and other relatively undisturbed areas that are home to many plant and wildlife species</li></ul>

naturalization	<ul style="list-style-type: none"> <li>• the regeneration of the state of an area before development</li> <li>• may include the planting of trees, shrubs and other natural plants, no mowing prescription</li> </ul>
niche	<ul style="list-style-type: none"> <li>• the role an organism plays in a community</li> </ul>
nymph	<ul style="list-style-type: none"> <li>• the developmental stage of an insect between egg and adult</li> </ul>
omnivore	<ul style="list-style-type: none"> <li>• animals that eat plants and animals</li> </ul>
organism	<ul style="list-style-type: none"> <li>• a living thing</li> </ul>
pH	<ul style="list-style-type: none"> <li>• a measure of acidity</li> <li>• ranges from 1 to 14 (1-acidic, 14-basic)</li> </ul>
pollution intolerant organism	<ul style="list-style-type: none"> <li>• an organism that due to its physical needs cannot survive in a polluted area</li> </ul>
pollution tolerant organism	<ul style="list-style-type: none"> <li>• an organism that is not physically limited and can survive in polluted areas</li> </ul>
producer	<ul style="list-style-type: none"> <li>• organisms that make their own food through photosynthesis</li> <li>• plants</li> </ul>
pupa	<ul style="list-style-type: none"> <li>• the developmental stage of an insect between larva and adult</li> </ul>
tributary	<ul style="list-style-type: none"> <li>• a drain or stream that empties into another watercourse</li> </ul>
upstream	<ul style="list-style-type: none"> <li>• the direction from which the water flows</li> </ul>
vertebrate	<ul style="list-style-type: none"> <li>• animals with a backbone</li> </ul>
watercourse	<ul style="list-style-type: none"> <li>• a moving body of water such as a stream, creek, river, or drainage ditch</li> </ul>
watershed	<ul style="list-style-type: none"> <li>• land drained by a watercourse and all its tributaries</li> <li>• also called a catchment area or drainage basin</li> </ul>
wetland	<ul style="list-style-type: none"> <li>• land that is seasonally or permanently covered with water or where the water table is close to the surface</li> </ul>

## Reference Books

The following books were used in developing this program and provide information and numerous activities that may be useful to teachers.

*BirdQuest*. 1991. Canadian Nature Federation.

*Conservation Education Sourcebooks - Volume 2*. 1984. Cataraqui Region Conservation Authority, Mississippi Region Conservation Authority and Rideau Valley Conservation Authority.

*Ecology: a Practical Introduction with Projects and Activities*. 1988. R. Spurgeon. Usborne Publishing, London.

*Environmental Explorations: Learning the Environmental Way*. 1982. Ontario Ministry of the Environment.

*Fishways - Intermediate/Senior: A Manual of Curriculum -based Lessons for Intermediate and Senior Level Teachers and Group Leaders on Fishes and Fisheries Management*. 1991. Ontario Ministry of Natural Resources.

*GREEN Sourcebook for Watershed Education*. 1996. S. Cole-Misch, L. Price and D. Schmidt, Global Rivers Environmental Education Network.

*Hands On Save Our Streams: The Save Our Streams Teachers Manual*. 1995. Izaak Walton League of America

*Making Nature a Natural Experience*. 1982. Ministry of Tourism and Recreation.

*Project Wild*. 1990. Canadian Wildlife Federation.

*Science Is*. 1986. Susan V. Bosak, Youth Science Foundation.

*Watershed Science for Educators*. 1999. Cornell Cooperative Extension, Cornell University.

*Wildlife in Jeopardy: Ontario's Endangered and Threatened Species and Habitats: Educational Resource Kit*. -. Federation of Ontario Naturalists.