

# CURRICULUM LINKS FOR ENVIRONMENTAL SCIENCE INVESTIGATOR PROGRAMS:

## AQUATIC INVERTEBRATES

## FISH ECOLOGY

## NATURE HIKE

## THE MARSH ECOSYSTEM

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## Introduction:

The River Institute offers a variety of programs for intermediate and high school groups:

- Aquatic Invertebrates
- Fish Ecology
- Human Genetics and DNA
- Water Quality and its Importance
- Nature Hike (at Cooper Marsh)
- The Marsh Ecosystem (at Cooper Marsh)

All programs are appropriate for grades 7 through 12 and connect to certain Ontario Ministry of Education Curriculum goals. This document is aimed to provide teachers with an idea of which curriculum goals will be covered by the following programs: Aquatic Invertebrates, Fish Ecology, Nature Hike (Copper Marsh) and The Marsh Ecosystem (Cooper Marsh). These four programs have a strong focus on wildlife biology and river and wetland ecosystems and all cover approximately the same curriculum goals. The Water Quality and its Importance and Human Genetics and DNA programs are listed in separate documents.

On the next page is a description of our programs, followed by an account of which curriculum components are covered. These components have been divided by grade level. Overall Expectations are listed (as put forth by the Ministry of Education). Teachers can expect that most of the Overall Expectations for the particular strand or course listed will be touched on during any of these four programs, as well as additional curriculum topics (listed in the “additional curriculum topics” section). Program content may vary depending on weather, current research projects or staff specializations. As such, the curriculum links may also vary within each program.

The following curriculum guides were used to produce this document:

The Ontario Curriculum: Grades 1-8 Science and Technology – 2007

The Ontario Curriculum: Grades 9 and 10 Science – 2008

The Ontario Curriculum: Grades 11 and 12 Science – 2008

## Program Descriptions

### Programs at the River Institute

**Fish Ecology:** Students will learn how to sample and collect fish in the St Lawrence River using seine nets and gill nets. They will catch fish from near shore or open water areas; identify them using scientific keys; and record the length and weight. The river ecosystem and the interactions of fish with their environment will be discussed. Although chest waders are provided for students, it is recommended that students also bring rain boots and a complete change of clothing. This program can be paired with the Aquatic Invertebrate program for a full-day outing.

**Aquatic Invertebrates:** Students will collect aquatic invertebrates from the St Lawrence River using various types of sampling equipment, and identify their samples using scientific keys. They will learn to calculate the biotic index of the sampling site based on their findings. Although chest waders are provided for students, it is recommended that students also bring rain boots and a complete change of clothing. This program can be paired with the Fish Ecology program or the Water Quality program for a full-day outing.

### Programs at Cooper Marsh

**Nature Hike:** A naturalist will guide students on an interpretive walk through the marsh. They will learn how plants and animals adapt to their environment, and how invasive species and seasonal changes affect the marsh ecosystem. Students may bring binoculars if they wish. Trails at Cooper Marsh are 1–3 km in length including sections on boardwalks.

**The Marsh Ecosystem:** Students will discover the diversity of living things in the marsh wetland by participating in hands-on activities. They will sample invertebrates from the river using nets, and learn to identify their samples using dichotomous keys. They will determine plant biodiversity using techniques such as quadrant area analysis. These activities will provide information about the importance of the marsh habitat for biodiversity and watershed management.

## Grade 7 Science and Technology

### Understanding Life Systems: Interactions in the Environment

Overall Expectations

*By the end of Grade 7, the student will:*

- assess the importance of human activities and technologies on the environment, and evaluate ways of controlling these impacts;
- investigate interactions within the environment, and identify factors that affect the balance between different components of an ecosystem;
- demonstrate an understanding of interactions between and among biotic and abiotic elements in the environment.

 Additional curriculum topics:

- Ecosystems (ecosystems are systems of interactions between living organisms and their environment, ecosystems are in a constant state of change, changes may be caused by nature or by human intervention, etc.)
- Energy transfer within a food chain and why an ecosystem is limited in the number of living things it can support.


## Grade 8 Science and Technology

### Understanding Earth and Space Systems: Water Systems

Overall Expectations

*By the end of Grade 8, the student will:*

- Assess the impact of human activities and technologies on the sustainability of water resources;
- Investigate factors that affect local water quality;
- Demonstrate an understanding of the characteristics of the earth's water systems and the influence of water systems on a specific region.

 Additional curriculum topics:

- Water is crucial to life, water systems influence climate and weather patterns and water is an important resource which needs to be managed sustainably.
- Local water issues (e.g. mercury contamination in the food web).

## Grade 9 Science

### B. Biology (Academic and Applied)

Overall Expectations

*By the end of the course, students will:*

B1. Assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts;

B2. Investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of these ecosystems;

B3. Demonstrate an understanding of the dynamic nature of ecosystems, particularly in terms of ecological balance and the impact of human activity on the sustainability of terrestrial and aquatic ecosystems.

 Additional curriculum topics:

- An example of human impact on aquatic ecosystems in this area is invasive species (Round Goby, Purple Loosestrife, European Frogbit, etc.)
- Key terms: bioaccumulation, biodiversity, ecosystem, sustainability, watershed.
- Scientific Investigation Skills and Career Exploration

## Grade 11 Science

### Biology (University and College Preparation) (2008)

#### B. Diversity of Living Things (University)

Overall Expectations

*By the end of the course, students will:*

B1. analyse the effects of various human activities on the diversity of living things;

B2. investigate, through laboratory and/or field activities or through simulations, the principles of scientific classification, using appropriate sampling and classification techniques;

B3. demonstrate an understanding of the diversity of living organisms in terms of the principles of taxonomy and phylogeny.

#### C. Microbiology (College)


Overall Expectations

*By the end of the course, students will:*

C1. assess the effects of microorganisms in the environment, and analyse ethical issues related to their use in biotechnology;

C2. investigate the development and physical characteristics of microorganisms, using appropriate laboratory equipment and techniques;

C3. demonstrate an understanding of the diversity of microorganisms and the relationships that exist between them.

 Additional curriculum topics:

- Using a dichotomous key to identify invertebrates and/or fish
- Scientific Investigation Skills and Career Exploration

## **Environmental Science (University/College and Workplace Preparation)**

### **B. Scientific Solutions to Contemporary Environmental Challenges (University/College)**

#### Overall Expectations

*By the end of the course, students will:*

- B1. analyse social and economic issues related to an environmental challenge, and how societal needs influence scientific endeavours related to the environment;
- B2. investigate a range of perspectives that have contributed to scientific knowledge about the environment, and how scientific knowledge and procedures are applied to address contemporary environmental problems;
- B3. demonstrate an understanding of major contemporary environmental challenges and how we acquire knowledge about them.

### **B. Human Impact on the Environment (Workplace)**

#### Overall Expectations

*By the end of the course, students will:*

- B1. analyse selected current environmental problems in terms of the role human activities have played in creating or perpetuating them, and propose possible solutions to one such problem;
- B2. investigate air, soil, and water quality in natural and disturbed environments, using appropriate technology;
- B3. demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored.

### **C. Human Health and the Environment (University/College and Workplace)**

#### Overall Expectations

*By the end of the course, students will:*

- C1. analyse initiatives, both governmental and non-governmental, that are intended to reduce the impact of environmental factors on human health;
- C2. investigate environmental factors that can affect human health, and analyse related data;
- C3. demonstrate an understanding of various environmental factors that can affect human health, and explain how the impact of these factors can be reduced.

### **E. Natural Resource Science and Management (Workplace)**

## Overall Expectations

*By the end of the course, students will:*

- E1. assess the environmental impact of the harvesting and/or extraction of resources, including ways of reducing this impact, and analyse threats to the sustainability of natural resources;
- E2. investigate methods scientists use to classify and monitor natural resources, and conduct investigations using those methods;
- E3. demonstrate an understanding of the sustainable use of resources and its relationship to the biodiversity and sustainability of ecosystems.

### Additional curriculum topics:

- Biotic and abiotic elements
- Biodiversity as a measure of the health and sustainability of an ecosystem
- Scientific Investigation Skills and Career Exploration