



Ontario Envirothon

LEARNING OBJECTIVES



Contents

Contents	6
Overall Objectives	7
Aquatic Ecology	8
Specific Objectives	8
Overall Objectives	8
Application/Analysis.....	9
Synthesis/Evaluation	10
Forestry.....	11
Specific Objectives	11
Overall Objectives	11
Application/Analysis.....	12
Evaluation/Synthesis	13
Soils.....	14
Specific Objectives	14
Overall Objectives	14
Application/Analysis.....	15
Evaluation/Synthesis	15
Wildlife	16
Specific Objectives	16
Overall Objectives	16
Application/Analysis.....	17
Evaluation/Synthesis	18

Overall Objectives

Students must be able to...

Aquatics

- A. Understand and describe the abiotic characteristics and processes of aquatic ecosystems
- B. Understand and describe the biotic characteristics and processes of aquatic ecosystems
- C. Describe the variety of aquatic environments, their characteristics and succession, and how they are affected by internal and external processes.
- D. Understand and describe practices involved in the conservation and management of healthy aquatic ecosystems and water resources

Forestry

- A. Understand and describe the physiology of trees
- B. Understand and describe the various characteristics and processes involved in forest ecology
- C. Understand and describe the methods and practices of the forest industry and of sustainable forest management
- D. Understand and describe practices involved in the conservation and management of healthy forest ecosystems and forest resources

Soils and Land Use

- A. Understand and describe the physical properties of soil and the processes of soil formation
- B. Understand and describe the chemical properties of soil and the chemical processes of soil formation
- C. Understand and describe the biotic and abiotic characteristics and processes of soil ecosystems
- D. Understand and describe practices involved in the conservation and management of healthy soil ecosystems and sustainable land use

Wildlife

- A. Understand and use identification tools to identify local mammal, bird, fish and herptile species
- B. Understand and describe the characteristics and processes of wildlife ecology, including habitat and community dynamics
- C. Understand and describe the impact of humans and human development on wildlife and wildlife ecology, and vice versa
- D. Understand and describe practices involved in the conservation and management of wildlife

Aquatic Ecology

Lakes, rivers, streams, and oceans are full with a vast diversity of life. These water bodies provide numerous wildlife habitats. The soils and trees surrounding water bodies affect water quality and run off into aquatic wildlife habitats. Aquatic environments tell us a lot about overall environmental health and how everything in nature is connected. So, WATER you waiting for? Get HOOKED on aquatics!

Overall Objectives

Students must be able to...

- A. Understand and describe the abiotic characteristics and processes of aquatic ecosystems
- B. Understand and describe the biotic characteristics and processes of aquatic ecosystems
- C. Describe the variety of aquatic environments, their characteristics and succession, and how they are affected by internal and external processes
- D. Understand and describe practices involved in the conservation and management of healthy aquatic ecosystems and water resources

Specific Objectives

Students must be able to...

- A. Understand and describe the abiotic characteristics and processes of aquatic ecosystems**
 - 1. Identify the physical characteristics of water and explain how those characteristics relate to or affect aquatic organisms
 - 2. Identify the chemical properties of water and explain how those properties relate to or affect aquatic organisms
 - 3. Know the processes and phases for each part of the water cycle and understand the water cycle's role in soil nutrient erosion, salinization of agricultural lands, and climatic influences
 - 4. Understand the concept and components of a watershed and be able to identify stream orders and watershed boundaries. Know the features of a healthy watershed and an unhealthy watershed
 - 5. Know how to perform and interpret chemical water quality tests and understand why aquatic organisms and water quality is affected by the physical, chemical and biological conditions of the water
- B. Understand and describe the biotic characteristics and processes of aquatic ecosystems**
 - 1. Describe the flow of energy through aquatic systems, emphasizing aquatic food chains and webs

2. Describe the cycling of nutrients within aquatic systems, including additions from upland systems, with particular attention to carbon phosphorous and nitrogen
3. Describe normal succession in Ontario's lakes, streams and wetlands
4. Define and illustrate carrying capacity, including the importance and effects of critical habitat
5. Know how to perform and interpret biological water quality tests, using benthic macroinvertebrate testing, and understand why aquatic organisms and water quality is affected by the physical, chemical and biological conditions of the water

C. Describe the variety of aquatic environments, their characteristics and succession, and how they are affected by internal and external processes

1. Describe with detail the composition of Ontario's aquatic communities (lakes, rivers, streams, wetlands, etc)
2. Relate the elements of aquatic communities to the physical characteristics and processes of their environments
3. Define habitat requirements for a variety of aquatic plant and animal species and illustrate with specific examples
4. Explain or show how a range of aquatic organisms have adapted to the characteristics of aquatic environments
5. Identify simple and diverse aquatic systems found in Ontario, and illustrate the advantages of biological diversity
6. Define a wetland and identify and describe the four major types of wetlands: swamps, marshes, fens, and bogs
7. Describe the values and benefits of wetlands
8. Understand the functions and values of riparian zones and identify riparian zone areas

D. Understand and describe practices involved in the conservation and management of healthy aquatic ecosystems and water resources

1. Identify the rights of Ontario's first nations with regard to aquatic resources
2. Identify Ontario's rare, threatened and endangered aquatic species, as identified by COSEWIC, and explain how and why selected species were reduced to those levels
3. Identify and describe a variety of non-native and invasive aquatic species affecting Ontario's aquatic ecology
4. Identify local and global sources of point and non-point source pollution and discuss methods to reduce pollution in Ontario's aquatic ecosystems
5. Understand and describe the effects that climate change has on aquatic ecology
6. Interpret a variety of laws, agreements, treaties, etc. that govern Ontario's water resources and aquatic environments
7. Identify a variety of major stakeholders and agencies, including Federal, Provincial and Municipal government bodies, that provide oversight of water resources in Ontario

Application/Analysis

Students must be able to...

1. Identify, using a field guide, dichotomous key or index, plants and animals commonly found in Ontario wetlands
2. Identify site-specific plants and animals that would be found in a given wetland
3. Identify a specific aquatic community (lake, river, stream, wetland, etc) based a small sample cluster of aquatic plant and animal species
4. Identify the habitat requirements of common Ontario aquatic plants and animals on site

5. Collect and interpret data using a variety of tools, including, but not limited to:
 - hand lens
 - secchi disk
 - ekman dredge
 - D-net
 - pH testing kit or pH meter
6. Carry out a number of tests (visual, water, soil, vegetation, etc) to determine if a site is best described as a swamp, marsh, fen or bog
7. Compare and contrast the physical characteristics of lakes and streams, as well as the adaptations of life to those environments
8. Understand and illustrate carrying capacity
9. Use a variety of tools to carry out water quality assessments (alkalinity, CO₂, nitrate, phosphate, chloride, turbidity, pH, hardness)
10. Calculate stream velocity and flow rate
11. Understand and report on the effects of point and non-point source pollutants on aquatic life

Synthesis/Evaluation

Students must be able to...

1. Demonstrate, using examples from Ontario, how current water use affects aquatic resources
2. Examine the effect of the introduction of non-native species in aquatic ecosystems, including origin, means of introduction, methods of control, and results (success/failure) of methods
3. Assess the application of current aquatic ecosystem and water resource management and control
4. Recommend plans for aquatic ecosystem and water resource management and control

Forestry

Forests provide us with clean air and numerous wildlife habitats and help to prevent soil erosion and improve water quality. They also provide us with over 5,000 products we use in our daily lives. By studying this module, you will understand the physiology and ecology of trees and forests, the steps taken to achieve balance between forest ecology and the forest industry, and the intricacies of managing one of Canada's most renewable resources.

Overall Objectives

Students must be able to...

- A. Understand and describe the physiology of trees
- B. Understand and describe the various characteristics and processes involved in forest ecology
- C. Understand and describe the methods and practices of the forest industry and of sustainable forest management
- D. Understand and describe practices involved in the conservation and management of healthy forest ecosystems and forest resources

Specific Objectives

Students must be able to...

A. Understand and describe the physiology of trees

- 1. Describe the parts of a tree
- 2. Explain how trees grow, from the process of photosynthesis through branch growth to trunk growth
- 3. Understand the method of and terminology required to utilise a dichotomous tree identification key
- 4. Know and identify the principle tree species of each of Ontario's forest regions

B. Understand and describe the various characteristics and processes of forest ecology

- 1. Identify and describe the major forest regions of Ontario and Canada
- 2. Identify how much of Ontario and Canada's land surface area is forests and describe how much forested land is Crown land and how much is privately owned
- 3. Understand and illustrate the process and stages of succession
- 4. Describe the process of photosynthesis and cellular respiration as they relate to the cycling of energy, carbon, and oxygen through abiotic and biotic components of the forest ecosystem

C. Understand and describe the methods and practices of the forest industry and of sustainable forest management

- 1. Identify the major types of forest products that are produced in Ontario and Canada

2. Identify the types and number of forest-related jobs in Ontario and Canada
3. Identify and describe the various cutting styles and silvicultural principles that are appropriate for and applied to various forestry sites
4. Explain the concepts of even-aged and uneven-aged stands
5. Explain the role wildfire plays in sustainable forest management, including causes, prevention methods, forest destruction, and forest regeneration
6. Describe the economic importance of forest-related industries to provincial, national and international economies
7. Explain how environmental concerns such as water quality, habitat, recreation and aesthetics are incorporated into forest management

D. Understand and describe practices involved in the conservation and management of healthy forest ecosystems and forest resources

1. Examine the historical importance of Ontario's forests, including their value to First Nations Peoples and to the natural environment
2. Identify Ontario's rare, threatened and endangered tree and plant species, as identified by COSEWIC, and explain how and why selected species were reduced to those levels
3. Identify and describe the main insects and diseases (both native and non-native) that affect Ontario's forests
4. Understand and describe the effects that climate change has on forest ecology
5. Interpret a variety of laws, agreements, treaties, etc. that govern Ontario's forest resources and ecosystems
6. Identify a variety of major stakeholders and agencies, including Federal, Provincial and Municipal government bodies, that provide oversight of forest resources in Ontario

Application/Analysis

Students must be able to...

1. Identify common Ontario tree species by leaf type, branching, bark, buds scales, twigs, site type, etc. using a dichotomous key, field guide or index
2. Identify harmful forest insects and evidence of their presence in a forest
3. Collect and interpret data using the following forestry equipment:
 - Dot planimeter / grid
 - Tree calipers (dbh)
 - Compass
 - Prism
 - Caliper tape
 - Increment borer / tree cookie
 - Stereo viewer (map reading)
4. Illustrate the classification of a variety of trees and plants by identifying similar and different characteristics
5. Explain the forest management cycle and each of its component parts: planning, harvesting, site preparation, regeneration, tending and protection
6. Consider the impact of certification on sustainable forest management (using the Sustainable Forestry Initiative, Forest Stewardship Council, and the Programme for the Endorsement of Forest Certification as examples)
7. Analyse issues related to environmental sustainability and the impact of technology on the forest ecosystem

Evaluation/Synthesis

Students must be able to...

1. Critique the perspectives of various stakeholders (industry, environment, government) as they relate to forest issues
2. Summarise the history of a tree by looking at growth rings (periods of drought, faster growth, scarring)
3. Recommend a management plan (or no plan) for a forested area
4. Construct the history of a forest site (e.g. Has the site been harvested? What style of cutting was used? What stage of succession is the site currently experiencing?)
5. Address current forestry issues from different perspectives (clear-cut vs old growth, prescribed burns in protected areas, pesticide use, etc)

Soils

Don't treat soil like dirt! Soil allows plants to grow, which in turn provide wildlife and vegetation habitat, food and oxygen. Soil is the foundation of all ecosystems. Understanding soil is vital to understanding environment health. Can you dig it?

Overall Objectives

Students must be able to...

- A. Understand and describe the physical properties of soil and the processes of soil formation
- B. Understand and describe the chemical properties of soil and the chemical processes of soil formation
- C. Understand and describe the biotic and abiotic characteristics and processes of soil ecosystems
- D. Understand and describe practices involved in the conservation and management of healthy soil ecosystems and sustainable land use

Specific Objectives

Students must be able to...

- A. Understand and describe the physical properties of soil and the processes of soil formation**
 - 1. Understand and describe soil structure in terms of three components: form, stability, and strength
 - 2. Understand and describe how different amounts of organic matter affect and are affected by soil structure and texture
 - 3. Identify and explain factors that influence soil temperature
 - 4. Understand and describe the factors affecting soil formation: additions, losses, translocations and transformations
- B. Understand and describe the chemical properties of soil and the chemical processes of soil formation**
 - 1. Understand and describe how soil pH affects plant growth
 - 2. Understand and describe the cation exchange process and relate it to soil fertility
 - 3. Identify and explain the benefits of soil organic matter to soil chemistry
 - 4. Identify and explain the essential nutrient elements in soil and describe how they affect soil fertility
- C. Understand and describe the biotic and abiotic characteristics and processes of soil ecosystems**
 - 1. Identify types of soil organisms and their functions within a soil ecosystem
 - 2. Understand and describe the carbon cycle and the nitrogen cycle and their effects on soil chemistry and subsequent plant growth

3. Describe the effects of each type of erosion on the landscape and capability for various kinds of plant growth
4. Explain how soil composition and fertility can be altered in an ecosystem and identify the possible consequences of such changes
5. Know that plants must receive essential micronutrients and macronutrients from the soil in order to be healthy, and understand that soil fertility relates to the physical and chemical properties of the soil in addition to the quantity of nutrients

D. Understand and describe practices involved in the conservation and management of healthy soil ecosystems and sustainable land use

1. Identify the rights of Ontario's first nations with regard to land use planning
2. Identify and describe best management practices for a variety of land uses, including agriculture and forestry, and explain why these management practices are used
3. Describe how invasive species can affect soil ecology
4. Understand and describe the effects that climate change has on soil ecology
5. Identify and describe erosion control methods (windbreaks, crop rotation, drainage, etc.)
6. Interpret a variety of laws, agreements, treaties, etc. that govern Ontario's soil ecology and land use management
7. Identify a variety of major stakeholders and agencies, including Federal, Provincial and Municipal government bodies, that provide oversight of land use and soil ecology in Ontario

Application/Analysis

Students must be able to:

1. Collect and interpret data using the following field equipment:
 - Soil triangle to determine soil class
 - Munzell soil colour chart or other colour charts
 - pH test kits or pH meters to measure soil pH
 - Soil test kits to determine preferred conditions for the growth of plants (i.e. nitrogen, phosphorus, potassium)
 - Use a soil probe and auger to extract soil samples
2. Describe and classify a soil profile using the Canadian System of Soil Classification and/or the Field Manual for Describing Soils in Ontario
3. Identify and measure soil horizons in a soil pit, photograph or sample
4. Name and map the soil orders of Canada and identify them on a map
5. Identify soil types according to textural characteristics
6. Classify soil structure according to aggregate characteristics (i.e. granular, blocky, columnar, platy, massive)
7. Relate stream velocity to sediment sorting

Evaluation/Synthesis

Students must be able to:

1. Relate how soil, water and air are interrelated
2. Use data and other observations of soils to explain prevalent vegetation in an area
3. Predict the types of soil organisms that would be found within a given soil type
4. Assess a site for evidence of erosion
5. Make recommendations on how to implement erosion control
6. Make on-site recommendations on how to improve soil quality

Wildlife

Discover the call of the wild! The biodiversity of animal species in Ontario and Canada is vast. Each species has a specific ecological niche in order for them and their ecosystem to thrive. Wildlife species depend on the soil, water and forest ecosystems to survive. It is important to understand wildlife as key indicators of environmental quality.

Overall Objectives

Students must be able to...

- A. Understand and use identification tools to identify common Ontario mammal, bird, fish and herptile species
- B. Understand and describe the characteristics and processes of wildlife ecology, including habitat and community dynamics
- C. Understand and describe the impact of humans and human development on wildlife and wildlife ecology, and vice versa
- D. Understand and describe practices involved in the conservation and management of wildlife and wildlife resources

Specific Objectives

Students must be able to...

- A. Understand and use identification tools to identify common Ontario mammal, bird, fish and herptile species**
 - 1. Understand and use a field guide, dichotomous key, or index to identify a variety of wildlife, including, but not limited to: insects and larvae (aquatic and terrestrial), reptiles, mammals (terrestrial and aquatic; large and small), birds, amphibians, and fish
 - 2. Identify the presence of wildlife based on a variety of indicators, including, but not limited to: scat, eggs, tracks, patterns on trees, sounds and calls, pest evidence, feathers, and nests

- B. Understand and describe the characteristics and processes of wildlife ecology, including habitat and community dynamics**
 - 1. Identify specific biotic and abiotic habitat components for common Ontario wildlife species
 - 2. Identify the requirements for survival for common Ontario wildlife species
 - 3. Know and explain why a certain species' habitat requirements might change and describe the changes
 - 4. Understand and describe the concept of carrying capacity with reference to a variety of common Ontario wildlife species
 - 5. Understand and describe succession in terrestrial (bare ground) and aquatic (pond) environments
 - 6. Define predator, prey, herbivore, carnivore and omnivore, and explain how each of them interact with each other

7. Understand and explain how predator-prey relationships and carrying capacity are related and give examples
8. Compare and contrast the difference between adaptable (generalized) and non-adaptable (specialized) wildlife

C. Understand and describe the impact of humans and human development on wildlife and wildlife ecology, and vice versa

1. Identify and explain reasons for wildlife habitat loss in Ontario
2. Explain how a change in weather/climate, topography or land use might modify the process of succession
3. Examine the factors (natural and external) that affect the survival and equilibrium of populations in an ecosystem
4. Understand and describe the effects that climate change has on wildlife ecology
5. Identify Ontario's rare, threatened and endangered wildlife species, as identified by COSEWIC, and explain how selected species were reduced to those levels
6. List examples of wildlife species that are non-native to Ontario
7. Identify and explain how non-native species arrived in Ontario
8. Describe how various non-native species have naturalized to Ontario and if and how they have been harmful

D. Understand and describe practices involved in the conservation and management of wildlife and wildlife resources

1. Identify the rights of Ontario's first nations with regard to wildlife resources
2. Understand and describe how the impacts of climate change on wildlife populations are being mitigated
3. Explain how Ontario's rare, threatened and endangered wildlife species, as identified by COSEWIC, are being managed to return populations to healthy levels
4. Recommend measures to remove/reduce impact of non-native species on Ontario Ecosystems
5. Interpret a variety of laws, agreements, treaties, etc. that govern Ontario's wildlife resources
6. Identify a variety of major stakeholders and agencies, including Federal, Provincial and Municipal government bodies, that provide oversight of wildlife resources in Ontario

Application/Analysis

Students must be able to...

1. Identify wildlife species common to Ontario using a field guide, dichotomous key, or index
2. Classify wildlife as rare, threatened or endangered species based on COSEWIC status categories
3. Analyse and evaluate population case studies by producing population growth curves for each of the populations in the study, and use the graphs to explain how different factors affect population size
4. Identify wildlife signs and describe their significance
5. Identify animals as predator, prey, herbivore, carnivore and omnivore
6. Identify an area as suitable habitat for certain wildlife species
7. Draw and explain food chains and food webs

Evaluation/Synthesis

Students must be able to...

1. Evaluate and assess a site as suitable habitat for common Ontario wildlife species
2. Describe and evaluate factors contributing to environmental resistance and the carrying capacity of ecosystems
3. Investigate sites for evidence of common Ontario wildlife species
4. Analyse how the change in one species' population can affect the entire ecosystem's food web