



Canon Envirothon
Curriculum Guidelines
AQUATIC ECOLOGY
CORE ACTIVITY OUTLINE

The key points for each Canon Envirothon topic are “fleshed out” into core activities.

- Each of the key points is included in one or more of the core activities.
- Each core activity contains extended activities, as well as the top resources and professional contacts. Key vocabulary words are also included.
- The National Science Standards suggest evaluations for each activity should encourage the students to process the data they collect during the activity, and provide solutions based on the data. This ties each activity into the issues portion of the contest.
- Evaluation is based on the information provided for each core activity and from the data students collect. This allows students to make educated decisions and create solutions for the key issues.
- Core activities will be evaluated using a performance-based assessment.

AQUATIC ECOLOGY CURRICULUM

Canon Envirothon Aquatic Ecology Key Points

- 1A Identify the processes and phases for each part of the water cycle.
- 2A Describe the chemical and physical properties of water and explain their implications for freshwater and saltwater ecosystems.
- 3A Analyze the interaction of competing uses of water for water supply, hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, industry, and others.
- 4A Discuss methods of conserving water and reducing point and non-point source pollution.
- 5A Identify common aquatic organisms through the use of a key.
- 6A Delineate the watershed boundary for a small water body.
- 7A Explain the different types of aquifers and how each type relates to water quantity and quality.
- 8A Briefly describe the benefits of wetlands, including both function and value.
- 9A Describe the benefits of riparian areas, including both function and value.
- 10A Describe the changes to the aquatic ecosystem based on alteration to the aquatic habitat.
- 11A Know methods used to assess and manage aquatic environments and be able to utilize water quality information to assess the general water quality of a specific body of water. This includes sampling, technique, and water quality parameters used to monitor point and non-point source pollution.
- 12A Be familiar with major methods and laws used to protect water quality (i.e., both surface and ground water) and utilize this information to make management decisions to improve the quality of water in a given situation.

Suggested Core Activities

- Students will create a model of the hydrologic cycle, and demonstrate how the cycle works by making a terrarium, recording their observations, and analyzing their data. (1A)
- Students will diagram an educational display which describes the chemical and physical properties of water, and explains their implications for freshwater and saltwater ecosystems. (2A)
- Using maps of Canada and the United States, students will show comparisons between the two countries in their top seven competing uses of water. Students will then divide into teams and debate methods of conserving water and reducing pollution. (3A, 4 A)
- Students will use an aquatic dip net to collect aquatic organisms and then use a key to identify them. The students will use binocular microscopes to identify the smallest organisms and make identification tubes for future study. (5A)
- Students will delineate the watershed boundary for a small body of water in their local area. They will then describe and list the benefits of wetlands, and riparian areas. (6A, 8A, 9A)
- Students will create a presentation display showing a below ground view of the different types of aquifers, and how each type relates to water quantity and quality. (7A)
- Students will describe how biological, chemical, and physical changes to the aquatic habitat can affect the aquatic ecosystem by making a power point presentation. (10A)
- Using a commercial test kit, students will compare local water sources for pH, dissolved oxygen, temperature, and turbidity. They will then analyze their data to determine which sources are healthy for fish and wildlife. (11A)
- Large amounts of algae bloom have been discovered in a local lake. Students will site the laws used to protect the lake's water quality, and recommend management decisions to improve the problem. (12A)

Top Resources:

- Environment Canada The Hydrologic Cycle. Excellent graphics and lessons.
http://www.ec.gc.ca/water/en/info/pubs/Intwfg/e_chap1b.htm (1A)
- Water Cycle Detailed graphics and information.
<http://ga.water.usgs.gov/edu/watercycle.html> (1A)
- USGS Physical and Chemical Properties of Water
<http://ga.water.usgs.gov/edu/waterproperties.html> (2A)
- Water Use Canada
http://www.ec.gc.ca/water/en/manage/use/e_use.htm (3A)
- Water Use USA
<http://ga.water.usgs.gov/edu/wateruse.html> (3A)
- Canada Water Efficiency and Conservation
http://www.ec.gc.ca/water/en/manage/effic/e_weff.htm (4A)
- Water Conservation USA
<http://www.epa.gov/watrhome/you/intro.html> (4A)
- USA Water Pollution
<http://www.epa.gov/ebtpages/watwaterpollution.html> (4A)
- Canada Water Pollution
http://www.ec.gc.ca/water/en/manage/poll/e_poll.htm (4A)
- Benthic Macro-invertebrates in Our Water
<http://www.epa.gov/bioindicators/html/benthosclean.html> (5A)

- Watersheds
<http://www.gov.owow/watershed/whatis.html> (6A)
- Locate Your Watershed USA
<http://cfpub.epa.gov/surf/locate/index.cfm> (6A)
- Locate Your Watershed Canada
<http://atlas.gc.ca/site/english/maps/freshwater/distribution/drainage> (6A)
- Globe Hydrology
<http://www.globe.gov/sda/tg/globetg.html> (ALL)
- Groundwater Aquifers
<http://ga.water.usgs.gov/edu/earthgwaquifer.html> (7A)
- Wetlands
<http://www.on.ec.gc.ca/wildlife/wetlands/aboutwetlands-e.cfm> (8A)
- Riparian Benefits
http://www.on.ec.gc.ca/wildlife/factsheets/fs_habitat-e.html#riparian (9A)
- Aquatic Ecosystem Perspective
http://www.ec.gc.ca/water/en/info/pubs/primer/e_prim05.htm#a2 (10A)
- Common Water Measurements
<http://ga.water.usgs.gov/edu/characteristics.html> (11A)
- Water Policy and Legislation Canada
http://www.ec.gc.ca/water/en/policy/e_policy.htm (12A)
- Clean Water Act
<http://www.epa.gov/r5water/cwa.htm> (12A)
<http://epa.gov/indicators/roe/html/roeWaterW.htm> (12A)

Aquatic Ecology Extended Studies

Students will study the maps and information of Duffins Creek watershed and explain how 18 guidelines can be used for land use planning and conservation practices to lower the impacts of urbanization.

- http://www.on.ec.gc.ca/wildlife/factsheets/fs_habitat-e.html#case1 (3A, 4A, 6A, 7A, 8A, 9A, 10A, 11A, 12A)

Students will create an educational display featuring the nine major threats to our oceans, and possible solutions for each threat.

- http://www.pewoceans.org/oceans/oceans_pollution.asp
(2A, 3A, 4A, 10A, 11A, 12A)

Students will measure the stream flow of two creeks in their local area, and determine the discharge volume of water in different seasons.

- <http://ga.water.usgs.gov/edu/measureflow.html> (2A, 11A)

Students will create a chart that outlines how climate change (global warming) might affect the regional water supply resources in their area.

- http://www.ec.gc.ca/water/en/info/pubs/primer/e_prim01.htm#a_4
(1A, 2A, 10A, 11A,)

Aquatic Ecology Team Presentation Assessment

Purpose: Using local, state, and provincial resources plus those provided in the core activities section, students will research and present a solution to the following water resource problem:

A major water using industry (students or instructor may choose) has selected your community for its newest facility. City officials predict it will double the water use, and increase the population of your community by thirty percent in the next five years.

Students will create an educational display and present their findings on where to locate the industry and the additional population so that it has the least impact on water resources and the watershed.

Include in the presentation:

- A watershed map that locates the industry and the additional population. (1A 2A 3A 4A 6A 7A 8A 9A 10A 11A 12A)
- Impacts on ground water and the water supply. (3A 7A 10A 11A 12A)
- Impacts on surface water and water quality. (3A 4A 5A 8A 9A 10A 11A 12A)
- Identification of the point and non-point water pollution changes and what can be done to minimize their impact. (3A 4A)
- A proposal to share the cost of water system improvements between the new industry and the local citizens. (3A 4A 6A 7A 10A 11 A 12A)
- Research and place a value on the costs of new water resources, treatment plants and storm water drainage. (10A 11A 12A)

Resources:

A complete glossary of aquatic terms can be accessed at:

<http://ga.water.usgs.gov/edu/dictionary.html>

Canadian Water Resources Association

http://www.cwra.org/Resource_Centre/resource_centre.html

Developing Successful Runoff Control Programs

<http://www.epa.gov/OWOW/NPS/facts/point7.htm>

Source Water Protection

<http://www.epa.gov/safewater/protect.html>

Ordinances and Supporting Materials

<http://www.epa.gov/nps/ordinance/osm7.htm>

The Hydrologic Cycle and Human Use

http://wps.prenhall.com/esm_wright_envisci_8/0,8543,1052341-,00.html

Assessments for **Canon Envirothon** Preparation

The National Science Standards recommend that multiple and varied assessments be employed when attempting to evaluate science understanding. Since the Canon Envirothon contest requires students to respond in a variety of ways (performance tasks, oral presentation, written response and graphics), the preparation for the Envirothon will incorporate each of these styles of assessment and evaluation.

Core Activities

Field surveys, model building and laboratory protocols each have specific learning targets. Many of the activities have built-in assessment sections. In general students should be able to:

- _____ Select and effectively use tools in a safe manner
- _____ Collect, record and analyze data in an organized fashion
- _____ Use resource material, manuals and field guides
- _____ Demonstrate teamwork while investigating solutions to problems
- _____ Clearly communicate the results of the investigations

Display Presentation Sessions

Students will provide solutions to problems presented in the issues portion of the contest. Teachers and team coaches should become familiar with the Canon Envirothon oral presentation scoring criteria. It is recommended that local agency professionals be invited to judge the presentations. <http://www.envirothon.org/competition/judging.php>

In general, students should be able to:

- _____ Ensure that all team members contribute to the presentation
- _____ Make the central theme clearly written or diagramed on the display
- _____ Use in context important vocabulary related to the topic
- _____ Include graphics that are technically correct and labeled
- _____ Use the display effectively during the oral presentation

On-line Sample Tests

The Canon Envirothon web site contains sample tests for each of the Envirothon topics and a list of issues. Many state and provincial Envirothon Web sites also contain sample tests.

<http://www.envirothon.org/competition/tests.php>

http://wps.prenhall.com/esm_wright_envisci_8/0,8543,1052341-,00.html

Energy and Solid Waste

- Current hydropower technology can have undesirable environmental effects on fish mortality and downstream water quality. Students will create an educational display detailing the undesirable effects, and the solutions being used to correct the problems.
<http://www.eere.energy.gov/RE/hydropower.html>
- Students will list significant point source pollution sites caused by landfills and industrial waste areas in Canada, and how they affect groundwater. They will then present solutions for these problems.
http://www.ec.gc.ca/water/en/manage/poll/e_howgrd.htm
- Students will create an educational chart detailing the technology for creating energy from ocean waves and tides.
<http://www.eere.energy.gov/RE/ocean.html>
- Students will study the effects of wastewater treatment, oil spills, and pulp and paper industry pollution in Canada, and describe the positive steps being taken to correct these problems.
<http://www.sdinfo.gc.ca/reports/en/monograph6/watqulty.cfm>
- Each day the oceans absorb enough heat from the sun to equal the thermal energy of 250 billion barrels of oil. Ocean Thermal Energy Conversion Systems (OTEC), convert this thermal energy into electricity, often while producing desalinated water. Students will create a power point presentation detailing the three types of OTEC systems.
http://www.eere.energy.gov/RE/ocean_thermal.html
- Students will list the environmental impacts on water quality from the following electricity generation technologies: natural gas, oil, nuclear, hydroelectric, and municipal solid waste burning.
<http://www.epa.gov/cleanenergy/impacts.htm>
- Using the national standards for wastewater discharge, students will list the effluent guidelines for the following: coal mining, landfills, oil and gas exploration, and centralized waste treatment plants.
<http://www.epa.gov/waterscience/guide>
- Students will research how landfill leaching affects groundwater. They will then present their solutions for this problem.
<http://cwmi.css.cornell.edu/TrashGoesToSchool/Landfill.html>

REFERENCES

National Renewable Energy Laboratory

<http://www.nrel.gov/>

Water Quality Canada

http://www.ec.gc.ca/water_e.html

Water Policy and Legislation Canada

http://www.ec.gc.ca/water/en/policy/e_policy.htm

Clean Water Act

<http://www.epa.gov/r5water/cwa.htm>

U.S. Dept. of Energy

<http://www.eere.energy.gov/>

Canada Renewable Energy

http://www2.nrcan.gc.ca/es/es/renewable_e.cfm