

Aquatic Ecology Learning Objectives and Resources

1. Identify the processes and phases for each part of the water cycle.
 - * *The Hydrologic Cycle*
<http://www.coloradocollege.edu/dept/ev/courses/EV211WWW/hydrological%20cycle.jpg>
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *What is the Water Cycle?* – U.S. Geological Survey
<http://ga.water.usgs.gov/edu/watercyclehi.html>
Click on glossary terms in the “A quick summary of the water cycle” section to learn about each component of the hydrologic cycle.
2. Describe the chemical and physical properties of water and explain their importance for freshwater and saltwater ecosystems.
 - * *Water Properties* – U.S. Geological Survey
<http://ga.water.usgs.gov/edu/waterproperties.html>
3. Analyze the interaction of competing uses of water supply: hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, industry, and others.
 - * *Water Use in the United States* – U.S. Geological Survey
<http://ga.water.usgs.gov/edu/wateruse.html>
Click on each of the competing water uses to learn more about each of them.
4. Discuss methods of conserving water and reducing point and non-point source pollution.
 - Water Conservation
 - * *Cleaner Water Through Conservation* – U.S. EPA
<http://www.epa.gov/region6/6wq/waterconserv/index.htm>
 - Reducing point and non-point source pollution
 - * *NPS: The solution begins with you* – MDEQ
http://www.michigan.gov/documents/deq/wb-nps-solution-begins_250583_7.pdf
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Understanding Water Quality Glossary of Terms*
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Waterways Watch Guide & Field guide to Waterway Observations*
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Brown Water, Green Weeds* – MDEQ
Provided on the 2010 Michigan Envirothon Resource CD.
A hard copy is provided in the Resource Packet.
 - * *Practical Tips for Home & Yard to Improve Water Quality* – MDEQ
A hard copy is provided in the Resource Packet
 - * *Getting to Know Your Local Watershed: A Guide for Watershed Partnerships* – Conservation Technology Information Center (CTIC)
<http://www.ctic.purdue.edu/KYW/Brochures/GetToKnow.html>
 - * *Reflecting on Lakes: A Guide for Watershed Partnerships* - Conservation Technology Information Center (CTIC)
<http://www.ctic.purdue.edu/KYW/Brochures/ReflectingLakes.html>

- * *Working Trees for Water Quality* – USDA
<http://www.unl.edu/nac/brochures/wtwq/wtwq.pdf>
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Water Quality Best Management Practices on Forest Lands* – MSU Extension
<http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2770.pdf>
Provided on the 2010 Michigan Envirothon Resource CD.
5. Identify common aquatic organisms through the use of the key.
- * *Benthic Macroinvertebrates* – Field Manual for Water Quality Monitoring
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Stream Insects & Crustaceans* – Izaak Walton League of America
<http://www.barnard.columbia.edu/iue/ForestCurricula/StreamInsectsCrustaceanIDKey.pdf>
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Key to Macroinvertebrate Life in the River & Key to Macroinvertebrate Life in the Pond* – University of Wisconsin Extension
<http://watermonitoring.uwex.edu/pdf/level1/pondkey.pdf>
<http://watermonitoring.uwex.edu/pdf/level1/riverkey.pdf>
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Macroinvertebrate Survey - Pond Water Quality Investigation & Invertebrate Sample Collection & Preservation*
Provided online at the Michigan Envirothon website and on the 2010 Michigan Envirothon Resource CD.
 - * *Benthic Macroinvertebrates in Our Waters* – U.S. EPA
<http://www.epa.gov/bioindicators/html/benthosclean.html>
Click on the name of the macroinvertebrates to learn more about each of them, paying special attention to their “indicator roles”.
 - * *Macroinvertebrate Identification Key*
Provided on the 2010 Michigan Envirothon Resource CD.
6. Delineate the watershed boundary for a small water body.
- * *What is a Watershed?* – U.S. EPA
<http://www.epa.gov/owow/watershed/whatis.html>
 - * *Getting to Know Your Local Watershed: A Guide for Watershed Partnerships* – Conservation Technology Information Center (CTIC)
<http://www.ctic.purdue.edu/KYW/Brochures/GetToKnow.html>
7. Be able to explain the different types of aquifers and how each type relates to water quality and quantity.
- * *What is Groundwater?* – MSU Extension
Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Groundwater Education in Michigan* – MSU Institute of Water Research
Read “What is Groundwater”, and then click on Groundwater Tutorial. Start with “The Water Cycle” and complete the entire tutorial ending with “Where is Groundwater Most Vulnerable?”
<http://www.gem.msu.edu/gw/gw.html>

- * *Groundwater Contamination* – MSU Extension
<http://web2.msue.msu.edu/bulletins/Bulletin/PDF/WQ34.pdf>
 Provided on the 2010 Michigan Envirothon Resource CD.
8. Briefly describe the benefits of wetlands, both their function and value.
- * *Wetlands Overview* – U.S. EPA
http://www.epa.gov/owow/wetlands/pdf/overview_pr.pdf
 Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Types of Wetlands* – U.S. EPA
http://www.epa.gov/owow/wetlands/pdf/types_pr.pdf
 Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Threats to Wetlands* – U.S. EPA
http://www.epa.gov/owow/wetlands/pdf/threats_pr.pdf
 Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Functions & Values of Wetlands* – U.S. EPA
http://www.epa.gov/owow/wetlands/pdf/fun_val_pr.pdf
 Provided on the 2010 Michigan Envirothon Resource CD.
 - * *Economic Benefits of Wetlands* – U.S. EPA
<http://www.epa.gov/owow/wetlands/pdf/EconomicBenefits.pdf>
 Provided on the 2010 Michigan Envirothon Resource CD.
9. Describe the changes to the aquatic ecosystem based on alteration to the aquatic habitat.
- * *Water: An Ecosystem Perspective* – Environment Canada
http://www.ec.gc.ca/water/en/info/pubs/primer/e_prim05.htm#a4
 Read sections “What is an aquatic ecosystem?” through “Why is aquatic ecosystem health important to humans?”
 Provided on the 2010 Michigan Envirothon Resource CD.
10. Know methods used to assess and manage aquatic environments and utilize water quality information to assess the general water quality of a given body of water (includes sampling techniques, water quality parameters used to monitor point and non-point source pollution).
- * *Common Water Measurements* – U.S. Geological Survey
<http://ga.water.usgs.gov/edu/characteristics.html>
 - * *Key Water Quality Indicators* – Rice University
<http://www.rice.edu/armadillo/Galveston/Chap6/water.quality.indicator.html>
 - * *Field guide to Waterway Observations & Waterways Watch Guide*
 Provided on the 2010 Michigan Envirothon Resource CD.
11. Be familiar with major methods and laws used to protect water quality (surface and ground water) and utilize this information to make management decisions to improve the quality of water in a given situation.
- * *Clean Water Act* – U.S. EPA
<http://www.epa.gov/lawsregs/laws/cwa.html>

Additional Internet Resources for Aquatic Ecology

Water Science Glossary of Terms – U.S. Geological Survey

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

Estimating Daily & Yearly Water Consumption – Providence Water

<http://www.provwater.com/consalc.htm>

Surf Your Watershed – U.S. Environmental Protection Agency

<http://cfpub.epa.gov/surf/locate/index.cfm>

Groundwater Aquifers – U.S. Geological Survey

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

Why Wetlands? – Environment Canada

<http://www.on.ec.gc.ca/wildlife/wetlands/aboutwetlands-e.cfm>

Interactive GIS Mapping "Understanding Your Watershed" – MSU Institute of Water Research

This is an interactive web-based mapping program utilizing GIS to display various features within a selected watershed in Michigan. You will need to create a login name and password (it's free). If you are unfamiliar with GIS, review the tutorial before beginning. It will take some practice to get familiar with zooming in on areas and changing data sets (remember to click on 'get updated map' button after every time you choose a new data set), but this can be a very useful tool.

<http://www.hydra.iwr.msu.edu/water/>