MASSACHUSETTS ENVIROTHON

2018 Mass Envirothon Current Issue

Partnering with Nature in Watersheds

Background and Strategies for Community Research 1.0*

The Mass Envirothon Current Issue challenges your team to investigate an important environmental issue as it occurs in your community, to develop recommendations, and to present your findings to a panel of judges at the Envirothon competition. Use the background and links on these pages as a starting point for your research into watersheds, natural infrastructure, and sustainable development in your community.

** Look for updates at https://massenvirothon.org/areas-of-learning/current-issue/2018-current-issue/*

The 2018 Mass Envirothon Current Issue asks: Can our communities work with the natural infrastructure of our watersheds toward sustainable development, even as climate change accelerates?

The answer is Yes. Partnering with natural processes at work in the landscape can not only strengthen the water-related ecosystem services we rely upon, but also conserve energy, slow climate change, and save money.

However, taking advantage of these partnering opportunities requires particular knowledge of the landscape and its people, scientific understanding of hydrological processes, engagement by communities and citizens, plus foresight, collaboration, and creativity.

To ensure that your Current Issue presentation is the best possible, your team should start with a **broad exploration**:

- Trace the boundaries of your watershed on a map. Where are the surface waters within this region? The groundwater resources? What land uses are represented?
- Where does your domestic/drinking water come from? Where does it go, and what is it carrying when it goes down the drain?
- How much of your watershed's full water budget does your community use? What ecosystem services support your community's water use? Who is planning for their long-term health?
- Where are gray and green infrastructure already working together to meet community water needs?
- Who is responsible for ensuring water supply? Wastewater treatment? Stormwater management?
- What organizations and individuals are advocating for water resources?
- What engineers and natural resource managers are engaged in this work? What problems are they addressing? What solutions are they offering?
- What "partnering" projects are already in place in your watershed? In the planning stages? Who is involved?
- How will climate change affect water resources in your community in the next 50 years?

Through this research, you will assess water infrastructure resources and needs, identify an important partnering opportunity, and make specific recommendations for action.

"Natural" and "green" infrastructure? Nature-based solutions? Partnering with nature?

From the World Resources Institute: *Natural ecosystems like forests and wetlands provide essential services to water utilities, businesses, and communities—from water flow regulation and flood control to water purification and water temperature regulation. To ensure these ecosystem functions and associated benefits continue, communities can strategically secure networks of natural lands, working landscapes, and other open spaces as "natural infrastructure." While concrete-and-steel built infrastructure will continue to play a critical role in water storage and treatment, investing in natural infrastructure can reduce or avoid costs and enhance water services and security as part of an integrated system to cost-effectively deliver safe drinking water.*

Now is a critical moment facing water resource managers and beneficiaries nationwide. Much of America's aging built infrastructure for drinking water is nearing the end of its useful life. Yet funds for investment in water infrastructure are drying up in an era of fiscal austerity. . . . Investing in integrated water management strategies that combine engineered solutions with natural infrastructure can reduce costs, enhance services, and provide a suite of co-benefits for communities and the environment. This integrated approach, beginning with the protection of drinking water at its source, is the future of water management. (http://www.wri.org/publication/natural-infrastructure)

From the U.S. Environmental Protection Agency: *Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits. . . . Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water. https://www.epa.gov/green-infrastructure/what-green-infrastructure*

Key background concepts for the 2018 Current Issue

Sustainable Development

Some tried and true definitions:

- The ***World Conservation Strategy*** (1983) defined **development** not necessarily economic growth or expansion of the built environment, but as *improvement in the quality of life*.
- ***Our Common Future*** (1987) defined **sustainable development** as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*.
- **In the 1980's the International Alliance for Sustainable Agriculture** defined **sustainable agriculture** – but could also have defined **sustainable watershed management** – as *ecologically sound, economically viable, socially just.*

Ecosystem services

These are *the benefits that human communities gain from natural landscapes and healthy ecosystems*. The concept is important because it encourages us to pay attention to the value of natural systems for sustainable development. Water-related ecosystem services include: drinking water supply, waste treatment, agriculture, wildlife habitat/biodiversity conservation, storm surge and flood mitigation, recreation and scenic value. A good introduction to the concept may be found at: http://www.esa.org/esa/wp-content/uploads/2013/03/issue2.pdf

Watershed Science

The US Geological Survey, particularly its ***Water Science School*** (https://water.usgs.gov/edu/) offers a comprehensive introduction to water science concepts and issues. For example:

- **WATER CYCLE -** also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth **:** https://water.usgs.gov/edu/watercycle.html (an interactive web page at https://water.usgs.gov/edu/watercycle-kids-adv.html)
- **WATERSHEDS -** an area of land that drains all the streams and rainfall to a common outlet: https://water.usgs.gov/edu/watershed.html)
- **WATER BUDGETS -** The quantity, timing, and quality of water flow and storage: https://water.usgs.gov/watercensus/water-budgets.html
- **ECOLOGICAL WATER –** an emerging science focused on the quantity, timing, and quality of water flow and storage required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on them: https://water.usgs.gov/watercensus/ecowater.html

  See also
  - USGS **Hydrologic Information and Data for Massachusetts** at https://ma.water.usgs.gov/infodata/
  - For a step-by-step guide to **calculating a wetland water budget**, see http://irrigationtoolbox.com/ReferenceDocuments/BasicWaterManagement/f64_wetland_water_budget.pdf
  - **Effects of climate change** on the water cycle: US Environmental Protection Agency **Climate Change Science** info from January 19, 2017 is still available at: https://19january2017snapshot.epa.gov/climatechange_.html

Watershed Management

- Massachusetts helped to put "watershed management" into practice more than 20 years ago, as a way to engage broad groups of stakeholders to think ecologically and transcend political boundaries and ideologies to find innovative ways to meet environmental and economic development needs.
- The guiding principles of the watershed approach remain the same: ***Partnerships*** *(Those people most affected by management decisions are involved throughout and shape key decisions, and concerns about* ***environmental justice*** *are addressed),* ***Geographic Focus*** *(on watersheds), and* ***Sound Management Techniques based on Strong Science and Data****.* (https://www.epa.gov/sites/production/files/2015-06/documents/watershed-approach-framework.pdf
- US Environmental Protection Agency's **Watershed Academy** *provides self-paced training modules and webcasts from national experts about a range of watershed management topics* at https://www.epa.gov/watershedacademy/online-training-watershed-management#themes
- The Massachusetts Executive Office of Energy and Environmental Affairs' ***Climate Change Adaptation Report*** (2011) includes many recommendations relevant to watershed protection and management: http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf
- UMass Extension's RiverSmart Communities Program: ***Supporting New England Communities to Become River-Smart: Policies and Programs that can Help New England Towns Thrive Despite River Floods*** https://extension.umass.edu/riversmart/policy-report

Natural Infrastructure in Watersheds

Landscape and ecosystem features have provided water-related ecosystem services through history. Too often, they have been taken for granted. Scientific and engineering knowledge, planning skills, and a sustainable development ethic, are necessary to use them wisely.

Are there examples of these forms of infrastructure in your watershed?

- Headwater forests
- Inland and Coastal Wetlands
- Floodplains
- Streams & rivers

- Aquifers
- Estuaries
- Coastal barrier islands, salt marshes, dunes

See:

- ***A New Way for Water: Protecting Fresh Water in Massachusetts***. https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/massachusetts/facesofconservation/ma-freshwater-brochure.pdf?redirect=https-301
- ***Floodplains by Design*** (video) https://www.nature.org/ourinitiatives/urgentissues/water/protecting-rivers/floodplains-by-design.xml
- ***Reconnecting Rivers to Floodplains Returning natural functions to restore rivers and benefit communities***
- https://www.americanrivers.org/conservation-resource/reconnecting-floodplains/
- ***Living in Harmony with Streams A Citizen's Handbook to How Streams Work*** http://floodready.vermont.gov/sites/floodready/files/documents/Stream%20Guide%201-25-2012%20FINAL.pdf

Engineered Green Infrastructure in Watersheds

A variety of management practices and infrastructure elements, from small-scale elements integrated into sites to larger scale elements spanning entire watersheds, are being implemented. These are from EPA's *What is Green Infrastructure?*

- *Downspout Disconnection*
- *Rainwater Harvesting*
- *Rain Gardens*
- *Planter Boxes*
- *Bioswales*
- *Permeable Pavements*
- *Green Streets and Alleys*
- *Green Parking*
- *Green Roofs*
- *Urban Tree Canopy*
- *Land Conservation*

See:

- ***Learn about Green Infrastructure*** https://www.epa.gov/green-infrastructure/learn-about-green-infrastructure Environmental Protection Agency resources on green infrastructure, including basic information, performance, climate resilience, research, cost-benefit assessments, policy, and regulations
- ***Soak Up the Rain*** https://www.epa.gov/soakuptherain
- ***Coastal Stormwater Management through Green Infrastructure: A Handbook for Municipalities*** http://www.mass.gov/eea/docs/mbp/publications/massbays-green-infrastructure-handbook.pdf
- ***Tools, Strategies and Lessons Learned from EPA Green Infrastructure Technical Assistance Projects*** https://www.epa.gov/green-infrastructure/tools-strategies-and-lessons-learned-epa-green-infrastructure-technical
- ***Green Infrastructure: Constructed Wetlands***, American Society of Landscape Architects https://www.asla.org/ContentDetail.aspx?id=43537

Agencies and Organizations

A large number of government agencies, local government entities, nongovernmental organizations are involved in the development of natural infrastructure for water needs and have good resources to offer:

Federal agencies

- **The US Environmental Protection Agency** (USEPA) is engaged in water issues across the board. Start with the ***Water Topics*** web page at https://www.epa.gov/environmental-topics/water-topics#our-waters
- **The US Geological Survey** (USGS) hosts ***Science in Your Watershed*** at https://water.usgs.gov/wsc/index.html

Massachusetts state agencies

- **Web links to Massachusetts science data and agency and citizen involvement by watershed:** http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/mass-watersheds/
- **EEA Municipal Vulnerability Preparedness program,** helping 71 Massachusetts cities and towns this year to develop action-oriented resiliency plans. http://www.mass.gov/eea/pr-2017/climate-vulnerability-preparedness-funding-awarded.html
- **Department of Conservation and Recreation, Office of Watershed Management,** managing Quabbin and Wachusett reservoirs and the water supply for the Boston metro area https://www.mass.gov/orgs/dcr-office-of-watershed-management
- **Department of Environmental Protection, links to programs for Wetlands and Watersheds:** http://www.mass.gov/eea/agencies/massdep/water/watersheds/
- **MassWildlife,** offers the ***Massachusetts Climate Action Tool***, an online tool that . . . *focuses on what people can do now to reduce climate change impacts on natural resources such as fish, wildlife, and their habitats, in the coming decades.* http://climateactiontool.org/

Non-Governmental Organizations (NGOs)

- **Massachusetts Audubon Society**, a leader in Mass environmental education and advocacy, has extensive resources on sustainable planning and development, including green infrastructure and low impact development, as part of its ***Shaping the Future of Your Community*** program at https://www.massaudubon.org/our-conservation-work/advocacy/shaping-the-future-of-your-community
- **Regional Planning Agencies** help local governments in planning efforts, with a strong focus on natural resources. Links to the all the RPAs can be found at http://www.massmarpa.org/who-we-are
- **Massachusetts Watershed Coalition (**http://www.commonwaters.org/) has published ***The Community Guide to Growing Greener*****,** a practical guide to stormwater management incorporating green infrastructure at http://www.commonwaters.org/images/stories/pdfs/community_guide_greener2.pdf

Engineering and consulting businesses

- The membership of the Environmental Business Council of New England http://ebcne.org/ includes many small and large engineering and consulting businesses that work on watershed and green infrastructure issues. Many other such businesses may be located in your community.

Local Municipal Government boards and offices:

- Conservation Commission – every Massachusetts town has one, responsible for wetland protection
- Planning Board – takes the lead on preparing Comprehensive Management Plans, including Open Space and Recreation Plans
- Department of Public Works – responsible for roads, culverts, water supply

Questions, Issues, and Opportunities for Partnering with Nature in Watersheds

Below is a sample of topics and issues that often arise in discussions around water resources and natural infrastructure. You may encounter these (and more!) in your community research:

- **Public awareness.** We tend to take our access to water for granted. There is a lack of public awareness of problems and sustainable solutions. How can public awareness and engagement be increased?
- **Planning.** Municipal master plans, open space plans, and land use regulations should coordinate with one another to reflect the community's goals. Together, these plans can encourage sustainable development. Are they coordinated in your community? Do they encourage the use of natural infrastructure?
- **New development.** Are Low Impact Development principles and practices being implemented in your community, where new construction is happening?
- **Local agriculture and recreation** are generally considered to be environmentally friendly, but they often involve intensive land and water use. What green infrastructure can be put to work in such cases?
- **Landscape fragmentation and discontinuity**. Can natural infrastructure remedy the issues that conventional gray infrastructure has created, such as fish passages and wildlife corridors?
- **Dams**. Small and large dams have been constructed all across New England, for many purposes, for many years. When they were built, they were seen to provide multiple benefits: water supply regulation, flood control, hydropower (mechanical and electrical), and recreation. But dams have negative effects, particularly on ecosystem health. And they require ongoing maintenance – much dam infrastructure in New England is aging. Are there dams in your community? What are the pros and cons of these forms of infrastructure today? Should we build more? Should we take them all down? Are there natural infrastructure alternatives for the benefits that dams provide?
- **Renewable energy**. There is an urgent need for transition to renewable energy sources in order to prevent runaway climate change. Are there technologies that can harness the latent heat and mechanical energy of water in an ecologically sound way?
- **Drought frequency and intensity** are expected to characterize climate change. How can natural infrastructure address this issue?
- **Flooding is also increasing in frequency and intensity.** What are the hazards for your community? How can you be prepared and resilient? Can investment in natural infrastructure help?
- **Warming temperatures in terrestrial and aquatic ecosystems**, caused by climate change as well as runoff from buildings and paving, leads to ecosystem stress and change.
- **Aging infrastructure**. Much water infrastructure in Massachusetts communities is aging and out of date. What role can natural infrastructure play in replacing its functions?
- **Does partnering with nature really save money?**
- **Fiscal constraints.** State and town budgets are strained. New green infrastructure technology is available, but planning and design, and ongoing maintenance, requires training and public education.
- **Pollution.** Floods, stormwater, and wastewater carry a wide variety of pollutants. How much of our water pollution problems will natural infrastructure, which emphasizes infiltration, address?

Getting Started on Your Community Research

This page introduces several starting points for your Current Issue research. To do a good job, your team will eventually need to be acquainted with all these areas. But you can start with any one of them. The resources and directions for research here barely scratch the surface of what is out there to be explored in your community. Don't feel limited by the suggestions here!

Starting Points:

▲ **Orient yourself with maps**

Trace the boundaries of your watershed. Where are the surface waters within this region? The groundwater resources? What land uses are represented?

- **Bird's Eye View.** A fun way to start is by flying over your watershed: http://www.bing.com/maps.
- **Which watershed am I in?** If you aren't sure what watershed you are in visit this map showing watershed and town boundaries: http://www.mass.gov/eea/docs/eea/water/watersheds-map.pdf
- **Oliver.** Oliver, the MassGIS online mapping tool at http://maps.massgis.state.ma.us/map_ol/oliver.php can be used to map a variety of themes related to water resources.
- **Team maps.** The Massachusetts Executive Office of Energy & Environmental Affairs provides registered Envirothon teams with large-scale color printed maps of their communities showing information for use in research and presentations.

▲ **Find people in your community who can help you find and interpret the water infrastructure around you.**

- Many watersheds have local citizen groups working on protecting and restoring their rivers and streams. To find a contact in your watershed, go to http://www.mass.gov/eea/agencies/dfg/der/technical-assistance/watershed-contacts.html or call the Mass Department of Fish & Game's Division of Ecological Restoration at (617) 626-1540.
- Contact your Conservation Commission for an orientation to wetlands and other water bodies
- Who is responsible for ensuring water supply? Wastewater treatment? Stormwater management?
- What organizations and individuals are advocating for water resources? Is there an active local watershed group?
- What engineers and natural resource managers are engaged in this work? What problems are they addressing? What solutions are they offering?

▲ **Follow the water**

- Where does your domestic/drinking water come from? Where does it go when it goes down the drain?
- What portion of the full watershed "budget" does your community use?
- What land uses are represented? What is their impact on watershed health?
- What is in your community's wastewater? How are you treating your downstream neighbors?

▲ **Assess the infrastructure**

- What gray and green infrastructure is already in place?
- Explore BOTH large and small scale infrastructure issues and opportunities – from under an acre to watershed-wide, and how they relate to each other.
- In what ways is your ecosystem healthy and resilient? Unhealthy? How is this affecting ecosystem services?
- How is your community expected to grow and change over the next few decades? What gray infrastructure is planned? What green infrastructure makes sense?
- Is there an Open space and Recreation Plan, or a Master plan, on file in your town hall?
- How might climate change affect this infrastructure and planning in the next 50 years?

▲ Spend time outdoors

Ground truth what you are learning from maps. See the landscape through the eyes of your resource people. Get your hands on that infrastructure! Be surprised. Get muddy and wet. Prepare to tell the judges at the Envirothon about the beauty and adventure you found.

The 2018 Current Issue Problem

In mid-March, your team will receive the 2017 Current Issue Problem, which will provide the specific questions that you will need to address in your Current Issue presentation at the May 18 Envirothon. You will also receive a copy of the scoring sheets that judges will use to score your presentation.

The 2018 problem will

- require you to be familiar with water infrastructure issues and opportunities on two scales: watershed-wide, and on a site of an acre or less.
- ask you to assess water infrastructure resources and needs, identify an important partnering opportunity, and make specific recommendations for action.
- ask you to do some calculation of the quantities of water involved in the issues and opportunities you focus on.

How the Current Issue presentation works:

- Five (and only five) members of your team will make your presentation to a panel of five to eight judges. Your coach and other team members will be able to observe but not participate. The judges' job is to listen, ask good questions, assess your work, and give you feedback on your research, your recommendations, and your presentation.
- You have 15 minutes for your presentation, followed by a 10 minute period when the judges can ask questions. You will be allowed to use posters, maps, and other visual aids, but no electricity is provided or allowed.
- The Current Issue Presentation score is 25% of your team's total Envirothon score.

Community Research & Community Action Awards

Your team works hard to prepare for your Envirothon Current Issue presentation. You deserve recognition for this work! And if your Current Issue research results in a service or action project that benefits your community, this also should be recognized. The Mass Envirothon Community Awards provide important recognition for your team, plus visibility for your school and your community. Teams who work to qualify for the awards tell us that they have a better Envirothon experience overall. Everybody wins!

These awards are optional and noncompetitive. They can be earned by any team that meets the requirements for the awards. You and your coach are responsible for certifying the quality and completeness of your work. For more information, see https://massenvirothon.org/areas-of-learning/activities-programs/community-awards/

Mass Envirothon Current Issue Resources

Current Issue guidance and resources, including this document, are assembled and updated for Mass Envirothon by Will Snyder, Extension Educator for UMass Extension's 4-H Youth Development Program.

More Current Issue information, including links to workshop presentations, is at https://massenvirothon.org/areas-of-learning/current-issue/.

Please call or write with your questions! Contact Will Snyder at wsnyder@umext.umass.edu or 413/545-3876.