

## SECTION 11 EDUCATION AND RESEARCH

### GOAL: Cultivate a watershed ethic.

- Provide decision-makers, youth, and the public with an improved understanding of interconnected natural systems and strategies for building environmentally and economically sustainable communities.
- Support scientific research that facilitates "ecosystem-based management" of water resources in the Chemung and Susquehanna Watersheds.

### CHALLENGE

Water is a precious resource. The ability of citizens to be good stewards of that resource begins with understanding. What is a watershed? How do the interconnected systems work? How have humans impacted water quality and the water cycle? What changes are occurring over time? What can be done to protect and restore watershed resources?

For future management decisions to be based on sound science, citizens and community leaders must be both knowledgeable and engaged. To accomplish this, water resource information needs to be readily available in user friendly formats. Learning should be engaging.

The foundation for watershed stewardship is built in childhood, through formal education and other learning opportunities. Incorporation of environmental and water resource studies in youth programs helps to form adults that understand and value environmental and natural resources. Building on this foundation, outdoor education centers, internet resources, mass media outreach and other educational programs establish a citizenry that is knowledgeable about natural resources and primed to support wise management decisions. In addition, scientific research and technical assistance are needed to enable land managers, municipalities, and others to develop creative solutions to complex issues at the local level.



Stormwater-floodplain model at Bath-Haverling School  
(bv Janet Thiboen).

***Key educational messages and research topics for building a "watershed ethic" in the Susquehanna-Chemung Basin are summarized in the other Action Plan goals:***

- *Keep the water clean and plentiful – It's priceless.*
- *Capitalize on water resources as economic assets.*
- *Use the landscape in ways that support healthy water systems.*
- *Live in harmony with streams.*
- *Floods happen, so be prepared.*
- *Preserve the rich diversity of plant and animal life.*
- *Rainwater is good: Slow it down. Spread it out. Soak it in.*
- *Support productive working lands that contribute to a healthy landscape.*
- *Navigate towards better roadway drainage.*
- *Connect people to nature.*

Financial resources are an ongoing challenge for schools, nature centers, research institutes, and others. Knowledge is another. Teachers, scout leaders, and other educators may not be comfortable with their ability to undertake a citizen science project or Soil and Water Conservation merit badge. Visiting educators with expertise about natural resources or training with environmental curricula can be a valuable resource.

The school curriculum doesn't include the time or the flexibility needed to engage students in local resource issues. Science is not a priority at the elementary level and the high school curriculum is driven by the Regents exam. A few teachers manage to

integrate science and environmental issues into other subjects. But all students need in-depth projects, field trips, and hands-on activities that promote “minds-on learning.”

Strong science is needed to effectively prioritize, implement, monitor, and evaluate the actions and policies that enhance the health of the Susquehanna-Chemung Watershed. This will require improved monitoring, computer models, and research. Research results must be integrated into science-based strategies for addressing environmental challenges, including: protecting and restoring water quality (locally and downstream in the Chesapeake Bay), identifying and managing flood hazards, preparing for drought, restoring ecosystem functions, protecting threatened and endangered species, increasing the sustainability of food production, and promoting healthy lifestyles. Most of this research is conducted by colleges and universities or by regional and federal agencies (Susquehanna River Basin Commission, US Geological Survey, and National Oceanic and Atmospheric Administration). The development of public policies based on this research is generally a government function. In addition, science-based technical assistance is provided by organizations such as Cornell Cooperative Extension (CCE), the Cornell Local Roads Program, and Soil and Water Conservation Districts (SWCDs). It is important to maintain intellectual resources within all of these organizations, secure financial support for essential research, and foster the communication needed to facilitate science-based policies and programs.

*“Education is the most powerful weapon which you can use to change the world.”*  
- Nelson Mandela

## RECOMMENDATIONS

**Watershed Education for Children: Promote water resource education for school aged children: (1) in the school curriculum, (2) through after school clubs and groups, and (3) elsewhere in their lives. Each student should have at least one “meaningful watershed educational experience” before graduating from high school.<sup>19</sup>**

11a. Increase the priority given to natural resource and water cycle issues in the elementary, middle school, and high school curriculum so that watershed schools graduate environmentally literate students.

Immediate action: Support ongoing efforts to develop and then implement an “Environmental Literacy Plan for New York,” which offers the framework for enhancing outdoor and environmental education.

Immediate action: Support efforts to improve science and environmental curriculum (by NYS Outdoor Education Association and Science Teachers Association of NYS), including increased use of “Project Based Learning” strategies, “21<sup>st</sup> Century Learning” strategies, and integration of Science, Technology, Engineering and Mathematics (STEM) into the rest of the school curriculum.

Immediate action: Promote integration of flood safety information into Driver’s Education and other programs by incorporating the “Turn Around Don’t Drown” message and resources.

5-year target: Establish a peer-to-peer training network through which teachers with experience using environmental curriculum and resources (such as Project Wet or stream models) provide training for other teachers.

5-year target: Develop a list of science fair ideas (and supporting resources) that relate to water and environmental issues. Distribute to teachers.

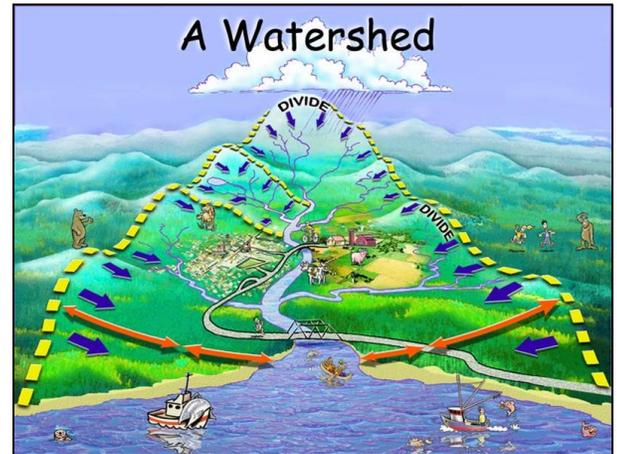
5-year target: Develop a resource list of interesting and technically accurate environmental books that are recommended for school and public libraries (such as the “Gaia Girls” adventure novels by Corning author Lee Welles and Envirothon resources). Survey libraries to determine which have these resources (or others). Share the results with community groups that may be able to purchase these resources for local libraries. Identify authors included on this resource list who are willing to meet with classes (in-person or by Skype), and provide libraries with contact information for these authors.

<sup>19</sup> This is the goal of the Meaningful Watershed Educational Experience initiative for the Chesapeake Bay.

5-year target: Make “Masters of Disaster” boxes (with safety curriculum developed by the American Red Cross) available to all schools in the watershed and provide training in use of these instruction modules.

Long-range target: Make stream testing kits and training on their use available to all science teachers within the watershed. Establish an online database for data sharing.

*Measure: Number of training sessions. Number of peer-to-peer training networks. Number of schools that receive resources.*



- 11b. Integrate environmental education projects into school curricula to provide students with “meaningful watershed educational experiences.” These are not one-day activities, but are extensive projects that engage students in hands-on outdoor investigations, classroom work, and restoration projects.

Immediate action: Seek funding to continue to offer the Chesapeake Bay Academy annually to provide teachers and other educators with in-depth training in water resource education.

Immediate action: Enhance and expand teacher training and networking opportunities through list serves, associations, and other means.

5-year target: Fund and establish a program that provides financial support for the additional costs required to implement “meaningful watershed educational experiences” (such as transportation expenses, equipment for monitoring, plants for restoration projects, etc.).

5-year target: Encourage “block” scheduling, which enables classes to be long enough for hands-on/minds-on activities and field trips.

*Measure: Number of in-depth training opportunities, networking opportunities. Number of mini-grants for “meaningful watershed educational experiences.”*

- 11c. Support and expand Conservation Field Day programs that provide a day of outdoor education at which students (usually 6<sup>th</sup> graders) rotate among stations. Some counties in the watershed offer this program, with coordination by Cooperative Extension offices or Soil and Water Conservation Districts.

5-year target: Find sponsoring agencies to run a Conservation Field Day program for each county in the watershed. Encourage organizers to work with volunteer presenters so that each station is engaging, hands-on, and educational (rather than demonstrations).

5-year target: Work with local schools to promote participation in Field Days, with the goal of 100% participation. If funding for transportation or substitute teachers is an impediment, solicit support from local civic groups.

*Measure: Number of Conservation Field Day programs throughout the watershed. Percentage of schools participating in Field Days.*

- 11d. Expand the availability and improve the skills of informal educators who deliver environmental programs to school groups, youth organizations, summer camps, and at public events. Educational resources include: Ronnie Raindrop (used by SWCDs to educate young children about the importance of water conservation and water protection), Enviroscape (large environmental model that demonstrates how polluted water and eroded soils move through the ecosystem), groundwater model (shows the movement of groundwater and contaminants through various types of soil), Project Wet (hands-on water-related activities for kindergarten through 12<sup>th</sup> grade), stormwater-floodplain model (demonstrates the relationship between land use and flooding), Emriver model (demonstrates stream behavior and erosion), and Focus on Floods educational materials (including classroom posters, coloring sheets, and activity worksheets).

Immediate action: Conduct train-the-trainer sessions to provide volunteer presenters and master teachers with the skills needed for fun and interesting presentations on water issues using existing models and other resources. Use these sessions as a networking event for nature center staff and other environmental educators in the watershed; encourage trainees to participate in Conservation Field Days, volunteer with youth organizations, and offer peer-to-peer teacher training.

5-year target: Procure funding to maintain, expand, and enhance the water resource educational programs conducted by nature centers, SWCDs and other organizations. This may include such things as: increased participation in schools and other programs, volunteer training/coordination, additional models or other supplies, development of new resources, printing costs, etc.

*Measure: Number of train-the-trainer sessions. Number of education programs.*

- 11e. Increase the integration of environmental issues into youth organizations and events. Promote existing environmental clubs and the creation of new clubs, which can provide opportunities for in-depth learning beyond what can be accomplished in the classroom.

Immediate action: Compile a resource list of existing water resource presenters, topics, materials (such as posters or activity worksheets), and other resources for each county (including models and other items that can be borrowed). Distribute this information to schools, youth organizations, camps, etc. Update and re-distribute annually.

5-year target: Identify schools that have existing environmental clubs. Document the successful strategies and distribute to schools, nature centers, and other potential sponsors.

*Measure: Number of schools that receive information.*

- 11f. Promote increased participation in the New York State Envirothon by recruiting teachers to identify interested students and serve as team advisors. Publicize the accomplishments of local teams. (Candor High School in Tioga County is a model for success, having repeatedly won the state competition.)

Immediate action: Ask teachers who have conducted successful Envirothon programs to mentor other teachers by conducting workshops or webinars and then being available to answer questions.

Immediate action: Compile a list of Envirothon subject experts in each county who can provide lessons on various topics (for Envirothon teams, classes, or other groups). Distribute this list to schools with Envirothon information.

5-year target: Increase the number of teams from watershed schools participating in the New York State Envirothon.

*Measure: Number of Envirothon mentors. Number of counties that distribute subject expert lists. Number of Envirothon teams.*

**Watershed Literacy for Citizens: Foster understanding of natural systems and expand citizen stewardship of those resources.**

- 11g. Provide media outreach pieces to increase understanding of watershed issues.

Immediate action: Write articles about watershed issues and release to all local media.

Immediate action: Write articles and work with local news stations to present “Environmental Stewards” segments highlighting local volunteer projects.

*Measure: Number of articles and TV news segments.*

*An **environmentally literate citizen** has a connection to the outdoor environment and a sense of place, understands the interconnectedness of all Earth systems, and is engaged and empowered to address environmental issues and their impact.*  
 - working definition in the “Draft Environmental Literacy Plan for NY”

- 11h. Work with outdoor education centers and environmental groups to hold hands-on and interesting presentations about water resource issues, such as flooding, water quality, wildlife, etc.

Immediate action: Provide water-related environmental education programs each year at nature centers, fairs, and other public events using models when available.

*Measure: Number of education programs.*

- 11i. Establish internships or other opportunities to engage high school and college students in implementing recommendations in this Action Plan. Environmental education recommendations in this section that would make excellent intern projects include developing county resource lists (11e) and assessment of school library resources (11a).

5-year target: Identify funding opportunities to create a Youth Conservation Corps.

5-year target: Develop a funding stream to establish an ongoing intern program.

*Measure: Number of intern projects.*

- 11j. Encourage environmental studies programs in the watershed's colleges and universities in order to promote environmental literacy among all graduates and to expand the number of students receiving in-depth training in water resource issues.

Immediate action: Meet with college and university educators to find out where environmental education already exists and identify barriers to expanding those programs.

Immediate action: Continue to pursue funding for undergraduate and graduate research on water resource issues.

*Measure: Number of environmental education programs and student research projects.*

- 11k. Enhance the network of places where people go to learn about the watershed. This includes nature centers, parks, museums, boat launches and other places.

5-year target: Develop a watershed display at each nature center, including information about the local connection to the Chesapeake Bay.

*Measure: Number of watershed displays.*

- 11l. Inspire love for the natural wonders of the watershed through photo contests (such as those conducted by the Broome County Environmental Management Council and the Otsego Land trust).

Immediate action: Encourage other organizations to sponsor photo contest highlighting the wonders of their location.

*Measure: Number of environmental photo contests.*

### **Research: Strengthen science to support ecosystem-based adaptive management.**

- 11m. Maintain and enhance ongoing programs that collect fundamental watershed data, such as the stream gauge network (operated by the U.S. Geological Survey) and water quality monitoring programs (by the Susquehanna River Basin Commission and the NYS Department of Environmental Conservation).

Immediate action: Provide local letters and other support for ongoing efforts to secure a permanent funding source for the federally-operated network of river gauges, precipitation gauges, and climate stations.

*Measure: Number of letters and other expressions of support.*

- 11n. Provide for coordination of water resource-related research in the Susquehanna River Basin.

Immediate action: Continue and improve the ongoing communication and coordination of research efforts that is provided by the Susquehanna River Basin Commission (for the entire Susquehanna Basin), Upper Susquehanna Conservation Alliance, and others.

Immediate action: Organize a consortium of universities and agencies to coordinate research efforts and help avoid duplication of efforts.

Immediate action: Hold annual water science forums (such as those held by the New England Interstate Water Pollution Control Commission). A portion of the forum could be devoted to presentations and papers, with another portion devoted to discussions that would help guide and develop research activities in the basin.

*Measure: Number of universities and agencies that participate in consortium. Number of water science forums held.*

11o. Seek additional funding for research on priority water resource topics.

Immediate action: Evaluate monitoring needs, identify research gaps, and continue to pursue funding for priority research projects.

*Measure: Amount of funding dollars received for priority water resource projects.*

11p. Improve the communication and technical assistance needed to promote science-based policy decisions.

Immediate action: Invite university researchers to participate in training for local governments and water resource professionals.

Long-range target: Improved scientific basis for water quality protection, water resource management, and hazard mitigation programs.

*Measure: Number of researchers that participate in training or assist with developing public policy.*

Research needs in the Susquehanna-Chemung Basin stem from a fundamental question: **How do human and natural systems impact the sustainability of water resources in the basin?** Some of the research needs are:

- Obtain a better understanding of the water quality impacts associated with natural gas development, including the impacts from infrastructure, industrial activities, water withdrawals, soil erosion, and stormwater runoff.
- Collect empirical data on watershed water budgets and evaluate water availability, particularly in the headwaters.
- Conduct additional research on the export of nutrients from headwater streams.
- Perform studies of freshwater mussels and the benefits they provide in filtering nutrients and sediment from the water column.
- Perform studies of surface water/groundwater interactions, especially as they relate to nutrient trading.
- Evaluate the impacts of climate change on the watershed hydrology and on human demands for water.
- Identify and quantify the benefits provided by wetlands in helping to manage both water quality and quantity.
- Evaluate strategies for promoting outdoor recreation and healthy lifestyles.
- Evaluate the barriers to outdoor and environmental education.
- Investigate the sociological aspects of why it is difficult to get people to engage in environmental stewardship.

11q. Promote citizen science projects that engage children and adults in collecting and evaluating data.

Immediate action: Increase the awareness of existing citizen science projects (such as those conducted by the Cornell Lab of Ornithology and Project BudBurst of the Chicago Botanic Garden) by distributing information about the best programs (fliers, web links, etc.) and providing training if needed.

5-year target: Initiate new water quality monitoring programs to collect data on local streams or lakes. Technical oversight and data evaluation can be provided by county Water Quality Coordinating Committees, Soil and Water Conservation Districts, the NY Citizens Statewide Lake Assessment Program (CSLAP), university researchers, or other partners.

*Measure: Number of citizen science programs promoted. Number of groups that receive assistance with water quality monitoring.*