

CHAPTER 5: RESEARCH NEEDS FOR SUSTAINABLE WATER RESOURCES MANAGEMENT: THE SWRR ANN ARBOR MEETING ON RESEARCH

At every meeting of the Sustainable Water Resource Roundtable, water resource experts shared information as well as perspectives on how to promote better decision making in the U.S. on sustainability of water resources. Discussions of research needs and opportunities for collaboration among public and private organizations have been central to our work from the outset. To further this objective, a workshop of experts was convened in April 2005 to explore research priorities with an emphasis on sustainability in the Great Lakes Region. While the meeting focused on the Great Lakes Region, the discussion and conclusions are broadly relevant to sustainability of water resources.

Hosted by SWRR and the University of Michigan, 75 experts convened for a two-day workshop April 5 and 6, 2005 in Ann Arbor Michigan. The workshop consisted of over 25 technical presentations on sustainability research by leading experts from six perspectives:

- Power Generation
- Agriculture and Forestry
- Urban Issues (water supply, storm water, wastewater, land use, etc)
- Manufacturing/Industry
- Ecological Protection and In-stream Uses
- Ethics, Law and Policy

The workshop also included breakout discussion groups on the above topical categories, with the exception of Ethics, Law & Policy, which was merged into discussions of the other five. Each group was charged with examining research needs from its special perspective and reporting back to the entire group. In plenary session, participants examined the differences, similarities and commonalities of the small group conclusions.

Several key observations emerged in the conversation, including the need to:

- Improve understanding of the critical water resource processes that impact sustainability
- Develop decision support models and tools
- Conduct a better inventory of critical data
- Adopt new monitoring technologies
- Develop a conceptual approach to quantify the value of water
- Establish new policies and law to manage water on a regional basis
- Solve the forecast drain in central human resources and knowledge

Each is very briefly described below based on discussion in the separate and plenary sessions.

Process Research: All groups recommended that a better understanding was needed of the cause and effect processes impacting sustainability, although the specifics often differed. However, one common issue was the need to better understand the link between land uses and water quantity, quality and ecological health.

Decision Support Tools: Although often using different terminology, all of the groups recognized a priority need for analytical tools and models that can support better decision making on sustainability relevant to policy decisions. Each of the groups highlighted a priority to develop, improve, and more widely use decision support tools/models. Specifically the groups saw a need to increase the use scientific knowledge and insights in policy decision making in a quantitative fashion; quantitative with respect to quality, quantity, uses and valuation.

Data Inventory: Each group recognized that predicting the future and making important policy decision was predicated on the need to have a more comprehensive understanding of current conditions. Each group emphasized the need to build a better inventory of current and baseline conditions, but here again they each focused on different elements of it ranging from better database management, to better inventory of land uses and water data, to better understanding of natural baseline variability and existing conditions, as well as better information in new pollutants

Technologies: There was broad agreement on the need for new monitoring technologies both for water quantity and quality, not only for traditional contaminants such as nutrients and bacteria, but exotics such as pharmaceuticals and viruses. Additional examples of new technologies could include wireless and remote sensing. Individual groups suggested the need for advanced treatment and water use efficiency technologies.

Value of Water in Policy Decisions: All the groups recognized that as a society and an economy we have poor quantitative understanding of the “value” of water. Here again, there was a consensus opinion that developing approaches that recognize the value of water in its various uses by different stakeholders was a key to guiding decision making for sustainability, protecting all uses. The value of water must be incorporated into policy decisions.

Better Law & Policies: All of the groups recognized that new regional and national policy was needed to better promote sustainability. How those policies would be created or implemented was not an area of consensus and in fact was an area of disagreement. However, the group did express two strong areas of agreement. First, policy was needed to promote sustainability and research through integration and better use of existing the operations of individual government agencies and creation of new approaches. Second, managing water resource sustainability must have a regional focus and needs to come from an understanding of regional hydrology and regional uses.

Human Resources: A surprising area of consensus discussion by the group of experts was the recognition that sustainability is threatened by a current forecast indicating a shortage of knowledgeable and experienced water professionals. The experts recognized that universities were producing fewer environmental scientists and engineers with relevant specialization than in the past and that over the next ten years a major segment of professionals with key knowledge would be retiring. This is true both in academia and in large agencies such as USGS and EPA. Research is needed as to how these critical human resources and knowledge base can be sustained.

Collaboration: One final area of commonality in all of the group discussions was the need to encourage more collaboration among agencies, with industry, among governments, NCOs, and

research institutions. The group strongly felt there were many shared interests and that our overall effectiveness would be greatly enhanced by more collaboration, whether by voluntary encouragement, economic incentives or policy/law changes.

The above were the overarching and consensus research recommendations of the experts at the SWRR Ann Arbor meeting. The detailed and specific recommendations provided by the individual sector groups are found in the SWRR report on the meeting titled Great Lakes Region Research Priorities Workshop (available on the SWRR web page). It is interesting to note that although the five groups were organized to evaluate research needs in the context of separate stakeholder perspectives needs that in the end there was considerable commonality to their separately conceived priorities. These underscore the realization that sustainability is a common interest, and vehicle for collaboration *not confrontation* among different users. Researching and promoting sustainability can best be realized by collaborative efforts.

The research recommendations are summarized in Table 1 below, which provides a matrix of research areas (Process Understanding, Inventory, Tools, Technology, Policy, and Law) mapped against the relevant sectors.

Table 5.1
Abstracted Summary of Sector Discussions on Research Needs for Sustainability

Urban	Power	Industry	Agri/Forestry	Ecology
Process				
<ul style="list-style-type: none"> Tolerable loss of water Population & land use impacts on quantity and quality 	<ul style="list-style-type: none"> Regional hydrology 	<ul style="list-style-type: none"> Factors that determine lake levels 	<ul style="list-style-type: none"> Soil loss Economic links to sustainability Effects of land use changes 	<ul style="list-style-type: none"> Quantification of stressors & receptors Definition of baseline conditions Resistance & resilience Resistance & resilience Effectiveness of BMPs
Tools				
<ul style="list-style-type: none"> Metrics to determine "value" of water 	<ul style="list-style-type: none"> Decision support tools Better methods for TMDL analysis Watershed, hydrology & biogeochemical models 	<ul style="list-style-type: none"> Predictive models Tools to understand and predict lake levels 	<ul style="list-style-type: none"> Decision support tools 	<ul style="list-style-type: none"> Decision support tools Improved criteria
Inventory				
<ul style="list-style-type: none"> Comprehensive data base of all uses Inventory of available water 	<ul style="list-style-type: none"> Aquifer data base Regional hydrology Technologies for water treatment and efficiency 	<ul style="list-style-type: none"> Inventory of baseline conditions Data base of emerging pollutants 	<ul style="list-style-type: none"> Database of land use Data base of emerging pollutants 	<ul style="list-style-type: none"> Comprehensive data base of all uses Inventory of baseline conditions
Technology				

Urban	Power	Industry	Agri/Forestry	Ecology
<ul style="list-style-type: none"> New monitoring technologies (quantity and quality) 	<ul style="list-style-type: none"> Water treatment technologies Fresh water conservation 	<ul style="list-style-type: none"> New monitoring technologies (quantity and quality) Conservation and reuse technologies 	<ul style="list-style-type: none"> Riparian management effectiveness & approaches 	<ul style="list-style-type: none"> New monitoring technologies (quantity and quality) Effectiveness of BMPs
Policy				
<ul style="list-style-type: none"> Value of water Shortage of appropriate engineers and scientists Stakeholder involvement Management structure Social landscapes Use allocation 	<ul style="list-style-type: none"> Value of water Shortage of appropriate scientists and engineers 	<ul style="list-style-type: none"> Lake level management Promote collaboration 	<ul style="list-style-type: none"> Science based policy Relation between economic factors and sustainability Public perceptions Valuation 	<ul style="list-style-type: none"> Criteria for social valuation Better defined goals Better collaboration
Law				
<ul style="list-style-type: none"> Land use taxation 	<ul style="list-style-type: none"> Water rights Integrated planning among overlapping agencies 	<ul style="list-style-type: none"> Regulatory incentives 	<ul style="list-style-type: none"> Policy tools 	<ul style="list-style-type: none"> Water withdrawal laws (indicator based)

There is new evidence that water scarcity will be the world's leading resource issue as we enter the new century.

— Lester Brown "State of the World, 1999