

## Sustainable Water Resources Roundtable



### Meeting at National Oceanic and Atmospheric Administration November 15-16, 2007 Proceedings

#### Participating in the meeting were:

Stephen Ambrose, NASA  
Shawn Arellano, NOAA  
Michael Bahleda, Bahleda Management & Consulting  
Gary Berg-Cross, EM&I, Spatial Ontology  
David Bernard, The Heinz Center  
David Berry, SWRR Manager  
Peg Brady, NOAA  
Steve Brown, NOAA/ NMFS/ST  
Michela Burla, NOAA/OPPI  
Ralph Cantral, NOAA/NOS  
David Clark, Rural Community Assistance Partnership  
Jeannine Cody, NOAA  
Erik Cornellier, NOAA/NOS  
Ellen Cummings US Army Corps of Engineers  
Liz Davenport, NOAA/NOS  
karen Eason, NOAA  
Michael Eberle, DOI/BLM  
William Effland, USDA/NRCS  
Reagan Errera, NOAA/OAR/LCI  
Peter Fippinger, NOAA  
Tim Goodspeed, NOAA  
Roger Griffis, NOAA  
Jawed Hameedi, NOAA/NOS  
Ted Heintz, White House CEQ  
Phillip Hoffman, NOAA/NMFS Protected Resources  
Susan Holdsworth, EPA/OWOW Monitoring Branch  
Dai Jihong, NOAA/NMFS/ST  
Gene Kim, NOAA  
Kristen Koch, NOAA Ecosystem Goals  
Rhonda Kranz, Kranz Consulting  
Laura Leston, NOAA/EGT  
Macara Lousberg, EPA/OW  
Jim Loving, IBM  
Doug McLaughlin, Nat. Council for Air & Stream Improvement  
Scott Mowery, NOAA  
Donna Myers, USGS/NAWQA  
Brand Niemann, EPA  
Pieri Noceti, DOE  
Elizabeth Norton , NOAA Ecosystem Goal Office  
Susan O'Brien, NOAA/NOS  
Robin O'Malley, The Heintz Center  
Michael Paul, Tetra Tech, Inc  
Larry Pugh, NOAA/ESCOR  
Thomas Purcell, NOAA  
James Renthall, BLM  
Steve Roda , NOAA  
Devon Rothschild, Ecological Society of America  
Mary Ann Rozum , USDA  
Cynthia Sellinger, NOAA Great Lakes ERL  
Denice Shaw, EPA/ORD  
Katherine Smith, NOAA  
Ethan Smith, SWRR Coordinator  
Rich Swanson, USFS  
Steven Swartz, NOAA/NMFS  
Michael Uhart, NOAA/OAR  
Nathalie Valette-Silver, NOAA  
Landon Vine  
Joan Warren, EPA/OWOW  
Dave Whittall, NOAA Science Center  
Harry Zhang, American Water Resources Association

## Day 1 Thursday November 15

### Opening

SWRR Co-chair Rick Swanson, USFS, welcomed the meeting attendees with a few comments on SWRR. David Berry, SWRR manager and facilitator gave a summary of the agenda and goals for the meeting.

### SWRR Background. Rhonda Kranz, Kranz Consulting

Rhonda provided a background on what SWRR is and what it does related to indicators, research, and outreach. SWRR is a national collaboration of federal, state, local, corporate, non-profit, and academic interests. See appendix A for SWRR brochure handout.

Mission: To promote sustainability of our nation's resources through

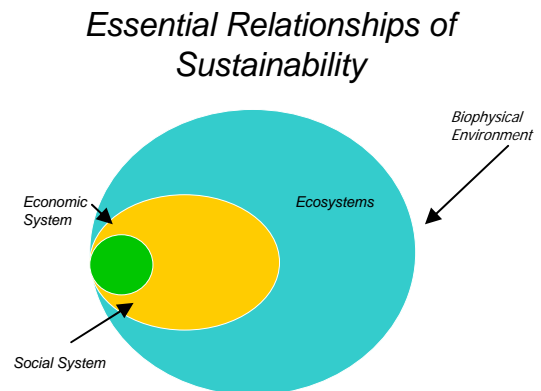
- Evaluation of information
- Development & use of indicators
- Targeting of research
- Engagement of people & partners

Principles of Water Sustainability

- The value & limits of water
- Shared responsibility
- Equitable access
- Stewardship

The Roundtable's efforts are based on a perspective that views economic systems as

embedded within social systems, both of which are embedded in the broader ecological system which includes all living organisms and the physical environment in which they interact. SWRR has hosted multi-stakeholder meetings on indicators, innovative initiatives, and research needs from 2002 through the present in California, Colorado, Maryland, Michigan, Minnesota, Virginia, and Washington, D.C. About 500 people from over 200 organizations have participated in these meetings. SWRR is one of four natural resource groups supporting the efforts of the White House Council on Environmental Quality to develop a comprehensive set of national environmental indicators. The other roundtables address issues and indicators for the management of forests, rangelands, and minerals and energy.



### “Developing Proposals for a System of Indicators on the Nation’s Environment (SINE).”

Ted Heintz, White House Council on Environmental Quality.

The role, objectives, and status of SINE

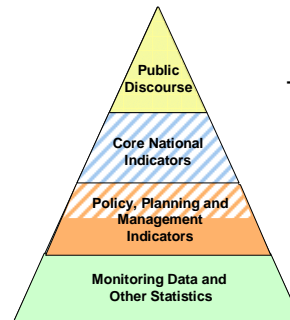
- National environmental indicators are: for high level policy, planning and management; regularly produced to high scientific and statistical standards; based on data that is consistent across the nation and through time.
- SINE will be of interest to a variety of Federal, State, Business, and NGO users.

- Possible Categories for National Environmental Indicators are: quality of air, water and land; extent and conditions of natural resources and environmental services; conditions and health of other living things; human health conditions affected by the environment; spatial distributions of resources and conditions.
- SINE needs improved institutional arrangements for: indicator selection & development; coordination of inventorying & monitoring to produce nationally consistent data; coordination of statistical production & reporting; coordination of information dissemination.
- Key leadership decisions to be made include: the scope of the SINE; policies and standards for the SINE; the set of National Environmental Indicators; the division of labor among federal agencies; timing of implementation and resource allocation.

#### National Academy of Public Administration Report recommendations

- The Administration should move ahead to develop a system of cross cutting environmental indicators
- States, localities and NGOs need to be engaged in the process.
- New institutional arrangements are needed but permanent organizational changes should not be made now.
- Move ahead quickly to build momentum that will carry through the transition.
- Undertake an intensive pilot to select indicators for a nationally important issue like water quantity.

### The Indicator Pyramid



The SINE will focus on indicators relevant to high level decisions about goals, priorities and outcomes.

### Group Discussion

#### Q&A with Ted

- Are the indicators to be tied to issues? Partly, but not so much as to become quickly obsolete.
- What about narratives like “good” or “not good”? Statisticians don’t like narratives.
- Can quantity and quality be separated? We need to know more. It depends on what the indicator is to illustrate.
- How does gross quantity relate to “days of usage”. Quantity available for specific users gets us to relate to quality for these uses.
- What about timing linked to reliability? Would have to provide supply at all points of the year.
- Would the pilot still have the same institutional arrangements, eg. The FACA Council, etc. as in the CEQ White Paper? Good question. It would certainly need it. Buts it’s a big job to do this for a pilot. Maybe the pilot is its first action.

## General Comments

- There must be a boundary that makes it “doable”. It will thus fall short of a full systems approach.
- The Feds don’t really manage water, but leave it to units like states. How then would a national quantity effort be useful? Examples of state projects included Atlanta, the Shenandoah Valley Conference.
- Perhaps there should be more than one pilot in different geographic regions, e.g. watered vs arid.

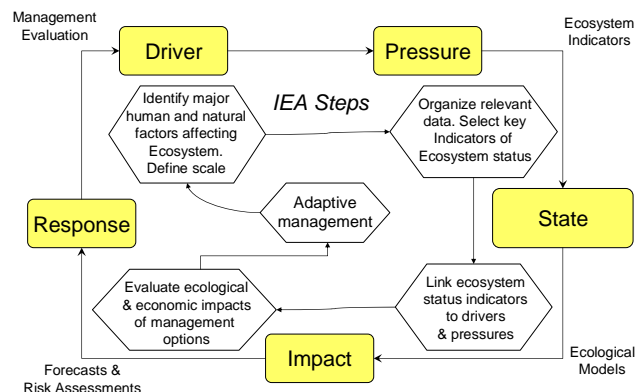
**Panel on Integrated Ecosystem Assessments and Integrated Indicators.** Moderator- Kristen Koch, NOAA, Ecosystem Deputy Goal Lead.

### “Ecosystem Indicators: Their Role in Moving Towards Ecosystem-Based Management.”

Steve Brown, NOAA, National Marine Fisheries Service, Office of Science and Technology, Chief of Assessment and Monitoring Division.

- The management of natural resources is transitioning from the traditional sectoral approach, as exemplified by single-species management of fisheries, to ecosystem-based approaches. The ecosystem-based approach considers a wider range of ecological, environmental, and human factors bearing on societal choices regarding resource use.
- Concepts and lessons learned in the development of ecosystem approaches to management of coastal and marine resources have relevance to the management of other types of natural resources, including water resources. After all, fish swim in the water...
- Agencies already are assessing many aspects of ecosystem components using indicators, but these generally are either sectoral or geographically constrained. For example, NOAA Fisheries Service's Our Living Oceans report on the status of living marine resource stocks, and the Puget Sound "Sound Science" report.
- In the marine realm, implementing ecosystem approaches to management depends on four key science needs: an operational ocean observing system, systematic reporting through Integrated Ecosystem Assessments (IEAs), ecosystem research on the linkages between human activities and changes in ecosystem indicators, and an analytical framework linked to an adaptive management approach.
- Desirable characteristics of indicators include: ease of understanding, responsiveness to manageable human activities, ease of accurate measurement, low responsiveness to other factors, measurability over a large portion of the area of interest, and availability of historical data to inform

### Applying the IEA Process: Indicators, Models, and Linkages



selection of thresholds and targets. In practice, these characteristics may be attainable to varying degrees (overfished and hypoxia examples).


- IEAs are a synthesis and analysis of quantitative information on relevant physical, chemical, ecological, and human processes in relation to specified ecosystem management objectives.
- IEAs are implemented through the Driver-Pressure-State-Impact-Response framework. This process adds value to indicators through linkage to models that generate forecasts and risk assessments of management scenarios. Responses to management actions are then evaluated as input to the next IEA cycle.
- IEAs can operate over a range of spatial scales, and can address many issues. They can be either paper (i.e., periodic published reports that establish benchmarks), or plastic (i.e., web-based assessments generated on demand to address ongoing or emerging issues as they arise).
- IEAs depend on partnerships, because no single agency has all the necessary information, expertise, or mandates, and they require stakeholder input.

**“National Water Quality Monitoring Network Design: Environmental Measures and Indicators.”** Jawed Hameedi, NOAA, National Ocean Service, Center for Coastal Monitoring & Assessment.

- A design for a National Water Quality Monitoring Network was produced under the aegis of the Advisory Committee on Water Information and submitted to the Office of Science and Technology Policy and the Council on Environmental Quality in April 2006. The design document, with contributions from over 70 individuals in government, academia, industry and non-governmental organizations, focuses on US coastal water and estuaries.
- The Network is conceived as a network of existing networks, but requires a continuum of observations from the watershed to the coastal ocean, connectivity with contaminant sources, consistent reporting of data, data quality assurance, data comparability, and a data management system that assures data exchange and retrieval capabilities.
- The Network design recommends multiple sampling schemes, suitable for addressing different information needs, including reconnaissance (aerial, space-borne, in-water, and shore-mounted sensors), a nation-wide probabilistic field sampling design, targeted or directed sampling within individual estuaries to determine causes and consequences of observed change, and high-frequency, automated sampling for determining short-term variability.
- Several Network Refinement Workgroups have identified specific measures and indicators that address 8

**Chronology: National Water Quality Monitoring Network**

- Ocean Action Plan (OAP) Action Item (December 2004)
- Developed by the Advisory Committee on Water Information (ACWI) - request from CEQ and NSTC
- NWQMN design report prepared by the NWQMC (January 2006)
- Revision and formal acceptance of report by ACWI and its delivery to OSTP/CEQ (April 2006)



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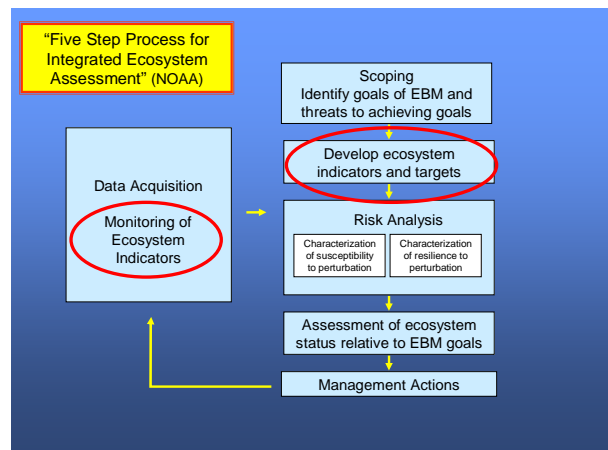
major water quality-related environmental issues. Each workgroup – with multi - agency representation as well as individuals from academic institutions and other non-governmental entities -- focused on a different environmental matrix or compartment: biology, nutrients, wetlands, contaminants, atmospheric deposition, etc.

- The Network implementation is following a 4-phase approach: Design (completed), Pilot Studies (to be completed in CY 2007), Demonstration (earmarked for CY 2008), and Nationwide Implementation (schedule to be determined later). Three pilot projects are underway: Delaware Bay, Lake Michigan, and San Francisco Bay.

**“Integrated Assessments, Integrated Indicators, Integrated System?”** Robin O’Malley, Heinz Center.

The presentation addressed relationships between indicators developed at different scales and for different uses, and between indicators and ecological assessments. Assessments operate either as tools to better understand an ecosystem, in which case indicators are often an assessment output, based on the assessment’s detailed review of ecosystem relationships and dynamics. Assessments can also serve as the vehicle for linking social goals, science, and management, in which case indicators are often a way to focus discussion among multiple parties.

There are a host of possibly overlapping and duplicative indicator efforts underway at present. We present the proposition that this redundancy will ultimately have to be reconciled for efficiency reasons and because there are important management and programmatic benefits to increasing consistency. A multi-level, multi-party, outcome-driven process can address this need, and the time is right to begin. Climate change will increase the need for observation of environmental change, the Council on Environmental Quality is raising the profile of this issue and may take formal action within the next year, and understanding of the benefits of increased consistency is growing.



## Group Discussion

Observations on the indicators described in the presentations:

- Indicators weren’t science driven. They were mostly policy and mission relevant to the agency where they were developed.
- The Indicators were developed in different stages.
- Some indicators were identified and available and some still need to be developed.
- The scale of the indicators was addressed. There is a need to bring the scale down to a local level.



Robin O'Malley suggested that everyone should get together to integrate their indicators. It was noted that integration isn't always supported by agency managers: funding is required and once there is integration an agency loses its autonomy. Integration focused at the watershed level was suggested.

Challenges:

- We are at the end of an administration—a chaotic time – which makes it difficult to get people to commit to carrying on this work.
- We need to find the link between indicators, assessments and users. How do we get the environmental indicators into a digestible form for the decision makers?

**“EPA’s Report on the Environment: Linking Environmental Indicators to Outcomes.”**

Denice Shaw, EPA, Office of Research and Development.

EPA’s indicator efforts focus on outcomes. EPA’s *Report on the Environment (ROE)* includes a compilation of indicators, evaluation of trends, and input for strategic outlook and priorities. ROE is organized around 23 questions considered to be important to EPA’s mission. It evaluated trends in air, water, land, human exposure and health, and ecosystems. ROE includes 85 peer-reviewed indicators. Nineteen are water indicators.

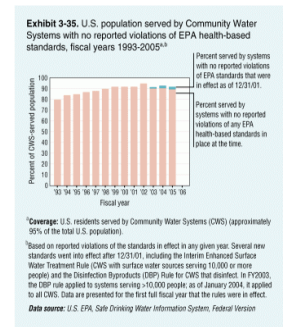
Water questions ask what are the trends in (extent) and condition of: fresh surface waters and their effects on human health and the environment; ground water and their effects on human health and the environment; wetlands and their effects on human health and the environment; coastal waters and their effects on human health and the environment; drinking water and their effects on human health; recreational waters and their effects on human health and the environment; consumable fish and shellfish and their effects on human health? High and Low Stream Flows.

The first draft version was released June 2003. It is being revised to address SAB public comments and include the latest year of data. The second version is expected to be released on Earth Day 2008. Challenges & Opportunities include data gaps, indicator research, analysis of trends, and strategic planning.



**Drinking Water Violations**

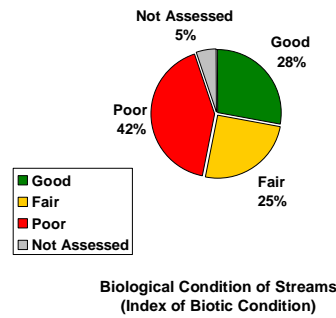
- U.S. population served by CWSs with no reported violations of EPA health-based standards was 79% in 1993, 94% in 2002, and 89% in 2005
  - Some regional variability over time
- Data do not include all water types (e.g., non-CWSs, private wells, bottled water) or indicate which contaminants exceed standards (or for how long or by how much)



**“National Aquatic Resource Surveys: Wadeable Streams Assessment Overview.”** Susan Holdsworth, EPA, Monitoring Branch, Office of Wetlands, Oceans, and Watersheds.

National Aquatic Surveys are conducted to provide statistically-valid, scientifically defensible reports on the condition of U.S. waters, and to answer questions regarding waters supporting healthy ecosystems and recreation, resources affected by water quality problems, water quality improvement, and the use of pollution control dollars. The Wadeable Streams Assessment (WSA) is a collaboration among EPA, states, tribes and other partners. It is the first statistically-valid report on the condition of the Nation’s streams, and provides a baseline from which to track changes over time. Proposed indicators for the next survey will measure aquatic biology, recreational/human health, and stressors.

## Wadeable Streams Assessment - Key Findings



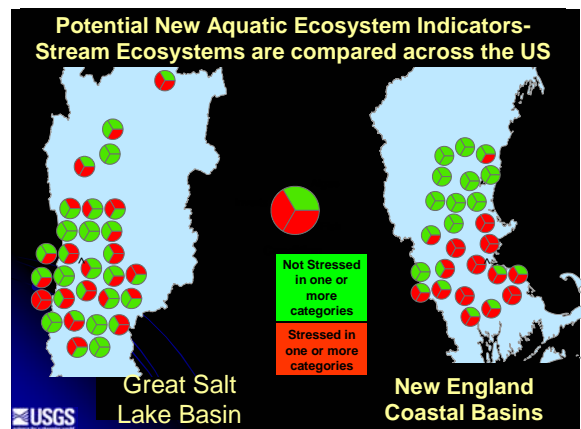
The WSA found 28% of streams in good condition, compared to least-disturbed reference condition.

Across the US 25-30% of streams have high levels of nutrients or excess sedimentation. These streams are twice as likely to have poor biology.

**“USGS support for Water Indicators.”** Donna Myers, USGS, National Water Quality and Assessment Program.

The USGS provides more than two dozen indicators for national reporting on water quantity, quality, and use. USGS provides data for land cover indicators and animal census data for indicators on amphibians and birds. These data and indicators are provided to the EPA and the Heinz Center for their State of the Environment and State of the Nation’s Ecosystems reports, respectively.

The USGS hosts a wealth of data to compute water indicators in its National Water Information System. These data include descriptive site information for all sites with links to all available water data for individual sites; water flow and levels in streams, lakes, and springs; water levels in wells; chemical and physical data for streams, lakes, springs, and wells on the World Wide Web. Currently, about 1,000 out of 7,000 real time gages from selected surface-water, ground-water, and water-quality sites provide near real time information.





**“Establishing Core Coast Indicators.”** Ralph Cantral, NOAA, National Ocean Service, Office of Ocean and Coastal Resource Management.

- There is a real need to establish a common set of indicators for coastal and ocean resource management that would be helpful to and avoid duplication among the various Federal agencies with responsibilities for coastal and ocean resource management.
- A lot of work has been done in the area of the environment and natural resources.
- Additional work is needed in the areas of social and cultural indicators, including human uses.
- Performance measurement for programs is difficult, if not impossible, without good contextual indicators.
- Indicators need to be established and then maintained in much the same format for a considerable length of time to show changes over time.
- Indicator development, monitoring, and implementation are often not the highest priority for funding, and therefore, essential information is often discontinuous.
- Continuous programs of monitoring (coupled with stable sets of indicators) are needed if we are going to be able to justify our resource management programs.

### Potential Core Community Indicators

- Coastal community structure
  - Population (diversity, seasonality)
  - Employment and income
  - Livability (social equity, hazards, etc.)
- Human health concerns
  - Beach closures
  - Shellfish closures
  - Fish contamination

**“Forest Service: C&I’s for: The World’s Largest Water Company.”** Rick Swanson, US Forest Service.

- Due to topography, location, vegetation and geology, the National Forests have a critical influence on the quantity and quality of the nation's waters.
- Water is the most valuable resource produced on the National Forests and Grasslands.
- The National Forests are the largest single source of water in the continental U.S. - 9% land base - 18% total U.S. run-off.
- 3400 communities (>66 million people) rely on FS lands for their drinking water source.
- The total value of water from FS lands in terms of instream and off stream uses exceeds \$7.2 billion.

Due to topography, location, vegetation and geology of the National Forest System, its lands have a critical influence on the quantity and quality of the nation's waters.



USDA Forest Service & Water

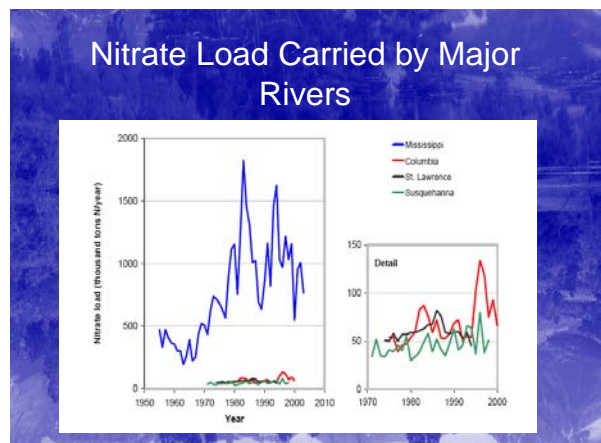
- Existing SWRR Framework Criteria and Indicators appear capable of examining sustainable water uses on FS lands.

**“Sustainable Water Resource Use: Proposed Indicator Framework.”** Rhonda Kranz, Kranz Consulting.

SWRR has been working since 2003 on the development of an indicator framework that can be used to identify trends, help evaluate causes and effects, and provide a common language and understanding of issues of sustainable water resource use. Our current indicator framework is the result of an iterative process in which proposed indicator frameworks have been modified based on feedback from over 500 SWRR participants who attended workshops over the last five years. The current proposed framework includes 14 indicator categories organized in five water resource related areas: water availability, water quality, human uses and health, environmental health, and infrastructure and institutions. In continuation of its indicator work SWRR will undertake a variety of activities including the following: solicit feedback to revise and refine the indicator framework; coordinate with other indicator initiatives; target sectors that have not had significant input in the indicator development process; and, address scalability of the indicators from the local to international level.

The SWRR Indicator Framework (see appendix B for complete framework)

- A. Water availability:
  1. Renewable water resources
  2. Water in the environment
  3. Water use sustainability
- B. Water quality
  4. Quality of water for human uses
  5. Quality of water in the environment
  6. Water quality sustainability
- C. Human uses and health.
  7. Withdrawal and use of water
  8. Human uses of water in the environment
  9. Water-dependent resource use
  10. Human health
- D. Environmental health.
  11. Indices of biological condition
  12. Amounts and quality of living resources
- E. Infrastructure and institutions.
  13. Capacity and reliability of infrastructure
  14. Efficacy of institutions



### Open Discussion on the SWRR Framework:

Suggestions for moving the framework forward

- Decide where SWRR ultimately wants the framework to go.
  - The framework may work best at the local and regional scale.
- Use the framework in pilots.

- Perhaps do a pilot at the same scale as the National Water Quality Monitoring Network (NWQMN).
  - SWRR has talked about doing a pilot program using the Anacostia Watershed and working with NGOs, but it has not happened.
- Present the framework at the ACWI meeting in February and get comments from all organizations.
  - We need to decide if we have something worth presenting and if the framework is populated enough.
- Determine what the framework adds to the NWQMN. See where there is overlap and expand the NWQMN with the framework.
- Determine which indicators are real priorities; which indicators we already have and are confident about; and which indicators we want but we do not have or do not have confidence in. This should help us determine where we need to focus on collaboration.
- Think about “horizontal integration” (i.e., the 50 states).
  - Use the indicator framework in cross-state projects.
  - Identify where there is economics in sharing—this will lead to integration.
  - Approach regional heads for collaboration.
  - Use what is working regionally and take it nationally.
- The framework needs to organize information across different scales but not dictate what anyone has to use. The data needs to be found easily, but it can’t be idiosyncratic. Use the framework to apply consistency at various levels (as in the Rangelands Roundtable).
- Ask business questions and layout business functions. Determine what the appropriate framework to capture water is (perhaps OMB FEA?).
- SWRR should be an activist for the existing framework—it does not need to be better, it is good enough.
- Climate change will hit water first. Use climate change as an opportunity to integrate the framework. Determine how the SWRR framework will reveal what is happening regarding climate change.

#### Concerns

- Some members are struggling with the potential for a thousand different indicators for each category.

On a positive note, the first environmental indicator was published in 1901. It is important to remember the positive examples of indicators.

## **Day 2 Friday November 16**

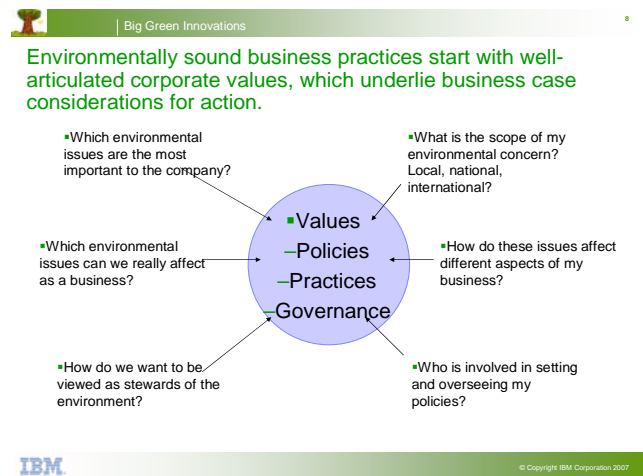
**“Big Green Innovations.”** Jim Loving, IBM Corporation.

Major areas of the presentation:

1. Requirements for Sustainability
2. Overview of IBM Sustainability activities
3. Observations and Potential Actions Regarding National Water Indicators

## Main points

- It is no longer speculation that solutions for sustainability are needed to address the challenges associated with Global Climate Change, Energy availability and consumption, and water availability and consumption.
- There are both market drivers for these solutions, along with values-based drivers.
- The U.S. Federal Government has a key role in the development of these solutions. There are several initiatives underway in the area of promoting and developing National Environmental Indicators and National Environmental Accounts.
- Governments and society will need to develop strategies with defined outcomes and leading indicators to determine the effectiveness of those outcomes, to adequately measure, monitor, and adjust the strategies.
- Applying innovation in this area, through the development of an approach for 'Societal Intelligence', will foster improved effectiveness in realizing desired outcomes.
- Environmental responsibility is a core IBM value, and is an area we have focused on for over thirty five years.
- IBM has several sustainability-related business initiatives in transportation, energy and power consumption.
- IBM has recently launched a new environmentally focused business called Big Green Innovations that will focus in 4-5 areas which include: Advanced Water Management, Green Operations and Supply Chain, Alternative Energy, Computational Modeling, and potentially a fifth around Carbon Trading.
- A set of Water Indicators that could be visible and used by key stakeholders and users early could potentially foster their further development, expansion and use.
- SWRR/US Federal government could consider proactively taking action around the Water Sustainability Indicators that will further collaboration among key stakeholders, and develop needed governance for data exchange standards. This activity could help in furthering the completion of the development of key water sustainability indicators along with their continued management and maintenance. SWRR could link to other initiatives underway within the NGO, congressional, and state and local government community to accomplish this.



## **Breakouts on Current State of SWRR Indicators**

Each breakout group was asked the following: 1) To review the list of categories in the framework to determine if it looks ok, and to note any gaps or jarring wording. 2) Does your organization have an indicator that fits a category? 3) What should SWRR do with the framework? How can this work be useful to your organization? Should SWRR volunteer as a coordinator of a pilot?

Breakout group summaries

### *Breakout Group #1:*

1) Overall, we believe the framework is at a good place for a national, cross-cutting level. However, we need to tweak the wording so there is less of a focus on freshwater and include marine (Jawed Hameedi can, perhaps, provide specific recommendations). We also need to revisit the Environmental Health category for a little tweaking. There is a gap in climate change indicators. We also believe that we need to clarify why the SWRR framework is unique so we are not duplicating efforts (also check the European framework and look at oceans and fisheries).

2) We did not discuss specific indicators, but found contact people at different agencies that can tell us what indicators are available at that agency.

- EPA: Denice Shaw
- NOAA: Jawed Hameedi
- USGS: Donna Myers
- USGS: Tim Miller

3) Suggestions included:

- Using the geospatial line of business as an example
- Bringing in the US Coast Guard as a SWRR member
- Populating the framework with a few indicators and taking it to ACWI in February for review and comments. Tim Smith volunteered to get the framework together by February.

### *Breakout Group #2:*

1) An additional category (or indicator) in business/corporation (economic) considerations is needed.

2) Additional suggested indicators include:

- Quality indicator for recycled water (e.g., thermogeneration)
- Water loss in distribution system after treatment
- Energy required per unit of water produced (efficiency measure)
- Agency assessments (availability)
- “Gray water” usages indices
- “Social” usage

3) SWRR could complete an assessment (pilot) at the national level.

- Need to seek funding

- Need to determine the audience and what the information will be used for (i.e., is it to be used for policy guidance?)
- Need to determine what the added value of the SWRR framework is (i.e., does it augment existing indicator efforts?)
- Tell the story
- Evaluate indicators
- Facilitation of indicators (i.e., standardization)
- Description of assessment

### *Break out group #3*

Participants: Karen Eason, Nathalie Valetto-Silver, Jim Renthal, Rhonda Kranz, Michael Paul, Kristen Koch.

#### 1. Comments on the framework

- In general the framework looks good and can be used as is (with a few edits)
- It would be helpful to organize the large list of 300+ indicators within the framework
- Things not obviously captured in the framework (might be in specific indicators): scarcity and quality; ecosystem services; periodicity
- Need to make sure illnesses and vectors are included in #10
- Need to make sure invasive species are included in #11
- Climate change should be included in D. The current language might not include that.
- Some of the categories seemed to be overlapping.
- In the descriptions of sections A and B the sentences should be edited to say “ecosystems provide” rather than “they” (people don’t provide the services).
- Suggested edits to the framework were provided.

#### 2. Suggested indicators or types of indicators and who can help find them

- An ecosystem service indicator for water quality that measures nutrient assimilation [Michael]
- Sediment triad for #11. Combines biological, physical, and chemical in to one indicator. [Nathalie, NOAA]
- Disruption levels of water resources and hydrological process impacts from the built environment (e.g. impervious surfaces). [Michael, and NOAA]

#### 3. What should SWRR do to move forward and what could help your organizations?

- Provide the framework with the full list of the organized 300+ indicators to agencies and ask the agencies if the proposed framework would work with their existing frameworks.
- Test some of the indicators.
- Rather than trying to homogenizing all the data collection efforts, perhaps it would be possible to develop an index of indicators that still allow for flexibility in data collection methodologies.



## **Closing Discussion**

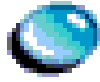
Tim Smith offered to take a first shot at populating the SWRR framework with indicators for discussion at the AQWI meeting in February. He will share his draft with the SWRR steering committee and others who are interested and who might have indicators to suggest.

Brand Nieman has set up a wiki page for the meeting at <http://colab.cim3.net/cgi-bin/wiki.pl?SustainableWaterResourcesRoundtable#nid3T77>. A wiki is a type of computer software that allows users to easily create, edit and link web pages. Wikis are often used to create collaborative websites, power community websites, and are increasingly being installed by businesses to provide affordable and effective Intranets or for use in Knowledge Management. Ward Cunningham, developer of the first wiki, WikiWikiWeb, originally described it as "the simplest online database that could possibly work". One of the best-known wikis is Wikipedia. The SWRR wiki page can provide a platform for shared information and discussion among SWRR participants and others interested in sustainable water issues.

**Powerpoint presentations and documents for this meeting can be found at the SWRR web site <http://acwi.gov/swrr/>**

## Appendix A

# The Sustainable Water Resources Roundtable



# SWRR

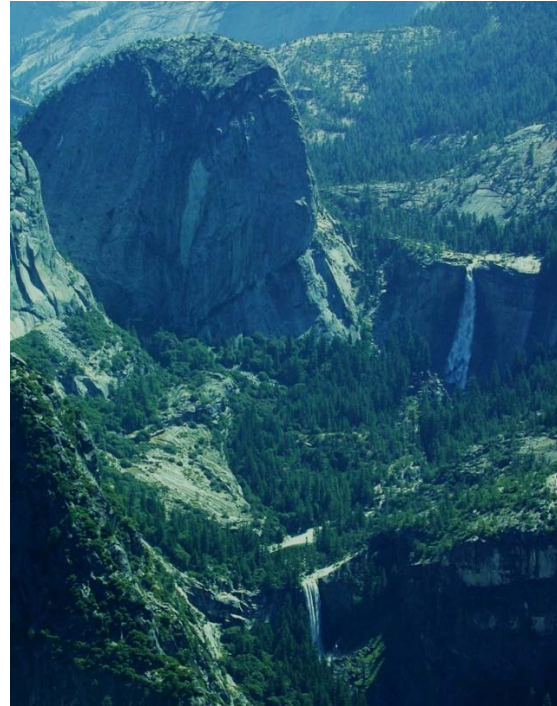


November 2007

*Since 2002, the Sustainable Water Resources Roundtable (SWRR) has brought together federal, state, corporate, non-profit and academic sectors to advance our understanding of the nation's water resources and to develop tools for their sustainable management.*

Because water resources have such a great influence on the vitality of our ecosystems, society, and economy, there is great interest throughout the country both in understanding trends in water quality and use, and in learning what can be done to manage the resource sustainably. We depend highly on water resources yet no single organization has the mission or mandate to address the full spectrum of water resource issues. This fragmentation of responsibility and a widespread interest in identifying water indicators of sustainability brought about the formation of SWRR.

Just as the participants in SWRR represent a wide range of interests and responsibilities related to water resources, we hope that its work is useful to a wide and diverse audience. To this end, we invite interested people and organizations throughout the country to participate in Roundtable activities.



Waterfalls at Yosemite David Berry

## Supporting Organizations

### University, Nonprofit and State

Alice Ferguson Foundation  
American Water Resources Association  
Annis Water Resources Institute  
Ecological Society of America  
Electric Power Research Institute  
Illinois State Water Survey  
Metropolitan Washington Council of Governments  
Minnesota Environmental Quality Board  
Rural Community Assistance Partnership  
Universities Council on Water Resources  
University of California, Santa Barbara  
University of Illinois  
University of Michigan, Ann Arbor  
Water Environment Federation  
Western Pennsylvania Watershed Program

### Federal

Advisory Committee on Water Information  
President's Council on Environmental Quality  
U.S. Department of Agriculture  
Natural Resources Conservation Service  
Forest Service  
U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
U.S. Department of Energy  
National Energy Technology Lab  
National Renewable Energy Lab  
U.S. Department of the Interior  
Bureau of Land Management  
Bureau of Reclamation  
Fish and Wildlife Service  
U.S. Geological Survey  
U.S. Environmental Protection Agency

## Mission and Activities

The Roundtable mission is to promote sustainability of the nation's water resources through:

- Evaluation of information
- Development and use of indicators
- Targeting of research
- Engagement of people and partners

The end goal is to improve the management, conservation and use of water and related resources at local, watershed, national, and global levels.

The Roundtable is one of four natural resource groups supporting the efforts of the White House Council on Environmental Quality to develop a comprehensive set of national environmental indicators. The others address issues and indicators for the management of forests, rangelands, and minerals and energy.

The Roundtable has hosted multi-stakeholder meetings on indicators, innovative initiatives, and research needs from December 2002 through May 2007 in California, Colorado, Maryland, Michigan, Minnesota, Virginia, and Washington, D.C. About 500 people from over 200 organizations have participated in these meetings.

The Roundtable is chartered by the Advisory Committee on Water Information, which advises federal agencies responsible for managing water resources. It receives funding from public agencies and the private sector.

## Reports

A September 2005 Roundtable report describes conceptual foundations of the group's work, the role and selection of indicators, and a set of draft criteria and indicators on the sustainability of water resources. This preliminary report also outlines research needs for sustainable water management identified at various meetings and covered in depth at an April 2005 University of Michigan workshop. The report present conclusions, recommendations and needed future work, and suggestions on how various partners might work to achieve the sustainability of water resources. The appendices present a discussion of the water budget approach to

management, and a full list of candidate indicators. The SWRR report can be found at [http://acwi.gov/swrr/Rpt\\_Pubs/prelim\\_rpt/index.html](http://acwi.gov/swrr/Rpt_Pubs/prelim_rpt/index.html).

## Sustainability Principles

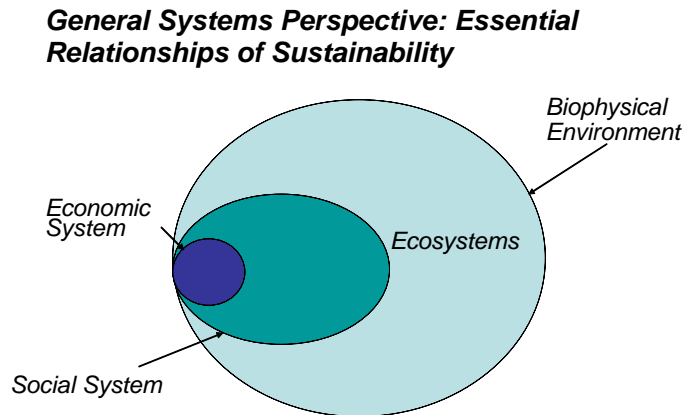
Discussions of water sustainability offer most promise when they take place with an understanding of major driving forces like population, income, land use, climate change, and energy use. To help it navigate within such a context, SWRR identified a set of four sustainability principles for water resources management:

1. ***The value and limits of water.*** Water supports all life and provides great value. While water is abundant, people need to understand and appreciate that it is limited in many regions, that there are environmental and economic costs of depleting or damaging water resources, and that unsustainable water and land use practices pose serious risks to people and ecosystems. A renewable natural resource is sustainable only if the rate of use does not exceed the rate of natural renewal.
2. ***Shared responsibility.*** Water does not respect political boundaries. Sustainable management of water requires consideration of the needs of people and ecosystems up- and down-stream and throughout the hydrologic cycle, and avoiding extreme situations that may deplete water in some regions to provide supplies elsewhere.
3. ***Equitable access.*** Sustainability suggests fair and equitable access to water, water dependent resources, and related infrastructure. Equitable access requires continuous monitoring to detect and address problems as they occur, and means to correct the problems.
4. ***Stewardship.*** Meeting today's water needs sustainably challenges us to continually address the implications of our water resources decisions on future generations and the ecosystems upon which they will rely. We must be prepared to correct policies and decisions if they create adverse unintended consequences.

## Systems Concepts

The Roundtable created a set of concepts based on a general “systems” perspective to guide it in its work. These concepts are useful in the development of a framework for indicators to measure sustainability of water resources, and to determine what research is

needed. The figure below displays the relationship between ecosystems, which include all living things and their physical environment, and society, which represents all the human elements of the biosphere, including the economic system.



Source: Sustainable Water Resources Roundtable

## Indicators

*Indicators of water resource sustainability tell us “where we are” in meeting short and long-term ecological, social, and economic needs. Indicators highlight trends, help evaluate causes and effects, and give us a common language and understanding of issues.*

SWRR believes that effective indicators provide tools to make good decisions – and an opportunity to achieve sustainable and adaptive management of water resources. The analysis of sustainability indicators is an ongoing, iterative process. The current SWRR indicator framework is presented as a separate insert to this document and is posted at [http://acwi.gov/swrr/Rpt\\_Pubs/prelim\\_rpt/index.html](http://acwi.gov/swrr/Rpt_Pubs/prelim_rpt/index.html)

## Water-Related Research

At SWRR meetings, experts share perspectives on decision-making for sustainability of water resources and on research needs and opportunities for collaboration. SWRR and the University of Michigan convened a workshop of 75 experts in April 2005 to explore research priorities with a focus on the Great Lakes Region. Research priorities were discussed in six areas: power generation, agriculture and forestry, urban issues, manufacturing and industry, ecological protection, and ethics, law and policy.

Several key observations emerged including the need to:

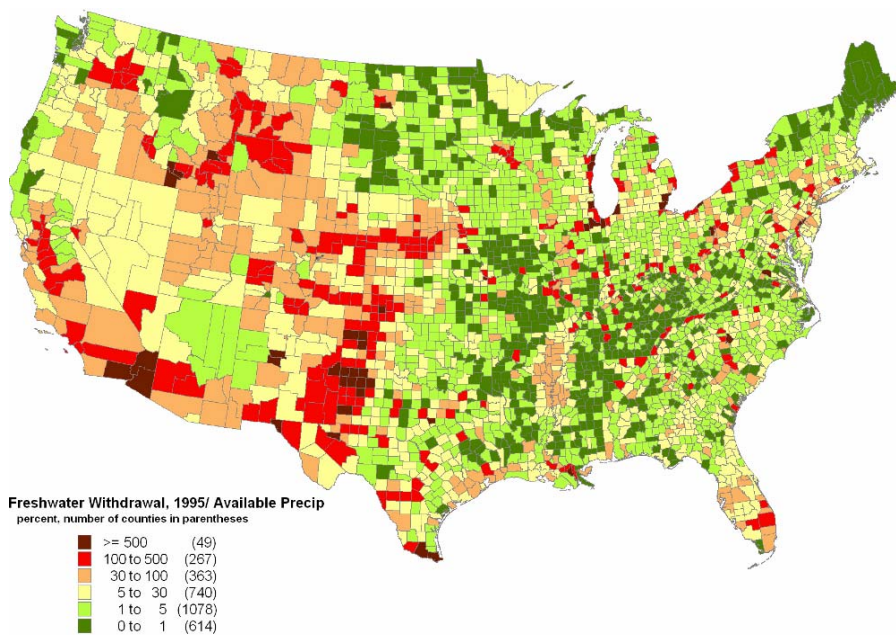
- Improve understanding of the critical water resource processes that impact sustainability.
- Develop decision support models and tools.
- Conduct a better inventory of critical data.
- Adopt new monitoring technologies.
- Develop a conceptual approach to quantify the value of water.

- Establish new policies and law to manage water on a regional basis.
- Solve the forecast shortfall in human resources educated in water resource issues.

### Tasks Ahead for the Roundtable and its Participants

- Revise and refine the indicators for tracking the sustainability of water resources, making them scalable to national, state, and local levels.
- Describe the need for Federal, State, and local agency programs to collect, manage, and analyze the information necessary for generating indicators.
- Expand contacts in the private sector.
- Continue meetings in different regions of the nation to disseminate information and to gain knowledge.
- Expand ties within the scientific community to ensure that SWRR employs state-of-the-art ideas in indicators development and to encourage additional research into water sustainability.
- Continue to consult with other indicator initiatives including the other four Resource Roundtables, Federal and State agencies, the Heinz Center for Science and the Environment, the State of the USA, and others on water-related indicators.
- Explore development of a National Forum on Sustainable Water Resources in partnership with other organizations and forums as recommended by Harvard University study on the work of the four Roundtables on Sustainable Resources.
  - Develop a training workshop for education in water sustainability principles.
  - Continue briefings on SWRR projects, products, meetings, and related water resource information

### Sample Indicator: Total Freshwater Withdrawal in 1995 (as % of available precipitation)



Source: Paper presented at SWRR meeting in Palo Alto, CA, March 2004. Roy, S.B., Ricci, P.F., Summers, K.V., Chung, C.-F. and Goldstein, R.A. Published as *Evaluation of the Sustainability of Water Withdrawals in the United States, 1995-2025*; Journal of the American Water Resources Association, 41(5):1091-1108, October 2005

**We welcome your participation in and support of the Sustainable Water Resources Roundtable.** Further information on SWRR can be found at <http://acwi.gov/swrr> Contact David Berry at [davidberry@aol.com](mailto:davidberry@aol.com) or Tim Smith at [etsmithsiri@aol.com](mailto:etsmithsiri@aol.com)

# Sustainable Water Resources Roundtable



SWRR



November 2007

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## The SWRR Indicator Framework

**Indicators represent a way to measure progress. They can provide a metric for understanding the extent to which water resources are managed to meet the long term needs of our social, economic and environmental systems. In essence, they can help us understand whether or not the nation is on a sustainable course in its management of water and related resources.**

**The roundtable proposes a five-part framework for organizing water sustainability indicators that represents the inherent interdependency of our nation's water resources:**

- Water availability
- Water quality
- Human uses and health
- Environmental health
- Infrastructure and institutions

**Fourteen key indicator categories fall within this framework. Others, described elsewhere, cover the ecosystem processes and social or economic drivers that influence the categories. See the roundtable's preliminary report at [http://acwi.gov/swrr/Rpt\\_Pubs/prelim\\_rpt/index.html](http://acwi.gov/swrr/Rpt_Pubs/prelim_rpt/index.html) for more information.**

**A. Water availability: People and ecosystems need sufficient quantities of water to support the benefits, services and functions they provide. These indicator categories refer to the total amount of water available to be allocated for human and ecosystem uses.**

- 1. Renewable water resources: Measures of the amount of water provided over time by precipitation in a region and surface and groundwater flowing into the region from precipitation elsewhere. USGS considers renewable water resources to be the upper limit of water consumption that can occur in a region on a sustained basis.**
- 2. Water in the environment: Measures of the amount of water remaining in the environment after withdrawals for human use.**
- 3. Water use sustainability: Measures of the degree to which water use meets current needs while protecting ecosystems and the interests of future generations. This could include the ratio of water withdrawn to renewable supply.**

**B. Water quality**



**People and ecosystems need water of sufficient quality to support the benefits, services and functions they provide. This indicator category is for composite measures of the suitability of water quality for human and ecosystem uses.**

4. Quality of water for human uses: **Measures of the quality of water used for drinking, recreation, industry and agriculture.**

5. Quality of water in the environment: **Measures of the quality of water supporting flora and fauna and related ecosystem processes.**

6. Water quality sustainability: **Composite measures of the degree to which water quality satisfies human and ecosystem needs.**

**C. Human uses and health. People benefit from the use of water and water-dependent resources, and their health may be affected by environmental conditions.**

7. Withdrawal and use of water: **Measures of the amount of water withdrawn from the environment and the uses to which it is put.**

8. Human uses of water in the environment: **Measures of the extent to which people use water resources for waste assimilation, transportation and recreation.**

9. Water-dependent resource use: **Measures of the extent to which people use resources like fish and shellfish that depend on water resources.**

10. Human health: **Measures of the extent to which human health may be affected by the use of water and related resources.**

**D. Environmental health. People use land, water and water-dependent resources in ways that affect the conditions of ecosystems.**

11. Indices of biological condition: **Measures of the health of ecosystems.**

12. Amounts and quality of living resources: **Measures of the productivity of ecosystems.**

**E. Infrastructure and institutions. The infrastructure and institutions communities build enable the sustainable use of land, water and water-dependent resources.**

13. Capacity and reliability of infrastructure: **Measures of the capacity and reliability of infrastructure to meet human and ecosystem needs.**

14. Efficacy of institutions: **Measures of the efficacy of legal and institutional frameworks in managing water and related resources sustainably.**

We welcome your participation in and support of the Sustainable Water Resources Roundtable. **Additional information can be found on the Roundtable at <http://acwi.gov/swrr>. Contact David Berry at [davidberry@aol.com](mailto:davidberry@aol.com) or Tim Smith at [etsmithsiri@aol.com](mailto:etsmithsiri@aol.com).**