

Integrated water management research in Mexico: Opportunity for North American collaboration

Ignacio Sánchez Cohen, José Manuel Maass Moreno, Ursula Oswald Spring, Philip Heilman, Jose L. Gonzalez Barrios, Gabriel Diaz Padilla, and Miguel Velasquez Valle

One of the most common approaches to natural resource management is to focus on watershed management. Many natural processes are integrated across a watershed, and upstream impacts on downstream water users are obvious. Often forestry or agriculture are the most prevalent land use in the headwaters, and municipal and industrial uses for water dominate in the urban areas downstream. Because many people are involved, there is an obvious potential to provide significant net benefits if watershed management can be improved.

In early September 2006, the National Council of Science and Technology of Mexico initiated a call for proposals for mega-projects in the areas of biotechnology, information and telecommunications technology, design and processes of manufacturing, nanotechnology and materials, rural and urban development (including social and economic aspects), water, and alternative sources of energy. The aim of the proposals was to develop a long-term research strategy to fill the gaps in knowledge in the different areas addressed as national security issues.

Ignacio Sánchez Cohen is the national coordinator of the Water and Soil Research Net of the National Institute of Forestry, Agriculture and Animal Husbandry Research in Mexico (INIFAP), Durango, Mexico. **José Manuel Maass Moreno** is the national leader of Mexican Long Term Ecological Research, Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Michoacán, México. **Ursula Oswald Spring** is a profesor at Centro Regional de Investigaciones Multidisciplinarias, Universidad Nacional Autónoma de México, Cuernavaca, México. **Philip Heilman** is a research biologist at the Southwest Watershed Research Center, USDA Agricultural Research Service, Tucson, Arizona. **Jose L. Gonzalez Barrios** is a researcher, INIFAP, Durango, México. **Gabriel Diaz Padilla** is a GIS modeler for INIFAP, Veracruz, México. **Miguel Velasquez Valle** is a researcher, INIFAP, Durango, México.

The National Institute for Forestry, Agriculture and Animal Husbandry Research of Mexico (INIFAP) responded by initiating a multi-institutional and multi-objective endeavor to organize the water research efforts of several institutions within the country having the vision of integrated water management. The national effort to prioritize water resources research on watersheds in Mexico is called the Mexican Decision Support (MEDS) project.

COMPARISON WITH PROJECTS IN UNITED STATES AND CANADA

The operational and research model for the MEDS project is similar to mega-projects reported in the United States and Canada.

In the United States, the national assessment component of the Conservation Effects Assessment Project (CEAP) is planned to provide scientifically credible estimates of the environmental benefits obtained from USDA conservation programs. The CEAP national assessment has two goals: (1) to provide the USDA Natural Resources Conservation Service and the conservation community with quantitative estimates of the benefits of conservation practices for national and regional reporting and (2) to assess the potential for existing conservation programs and future alternatives to meet the nation's environmental and conservation goals (USDA Natural Resources Conservation Service 2007). To achieve the proposed goals, small watershed case studies are being conducted through three CEAP watershed categories: USDA Agricultural Research Service benchmark watersheds (14 watersheds), USDA Natural Resources Conservation Service special emphasis watersheds (10 watersheds), and USDA Cooperative State Research, Education, and Extension Service competitive grant watersheds (13 project grants were awarded through October 2006).

Canada began a similar national effort, studying 18 watersheds located in the south of the country along the border with

the United States. The goal of Canada's Watershed Evaluation of Beneficial Management Practices (WEBs) project is to identify best management practices that minimize both environmental and economic negative impacts. Improving water quality is one of the main objectives in these watersheds.

In Mexico, according to results of integrated water management from the last two decades, mainly since 1996 when the watersheds councils were created throughout the country, there is a need to create and consolidate a private-public system for the effective management of water (Sánchez Cohen 2007). The system has to recognize the different social realities that may be found in distinctive watersheds and, based on a scientific platform, work toward social objectives that define formulae of economic and social commitment from users. Thus, the overall objective of MEDS is to develop quantitative measurement methods that allow elaborating scenarios of the hydrological cycle that consider social vulnerability and associated resilience practices and reconciliation of water, land, and other natural resource conflicts in contrasting watersheds in the country in order to provide sustainable management practices. This will allow the consolidation of a multifactor decision support system for generating social consensus that is politically acceptable by Mexican society and that promotes economic growth, social justice, and ecosystem sustainability.

Recognizing that local watershed problems have distinct hierarchy among farmers, questions to be addressed by MEDS are as follows:

- Where is the most vulnerable population located?
- What are the distinctive resource concerns among these watersheds?
- What are the more vulnerable productive systems and what are the most important characteristics that define their vulnerability?

Figure 1

Research and validation watersheds included in the Mexican Decision Support integrated water management mega-project.



Notes: INIFAP = National Institute of Forestry, Agricultural and Animal Husbandry Research in Mexico. UNISON = Universidad de Sonora. ITSON = Instituto Tecnológico de Sonora. IANL = Instituto de Agua de Nuevo Leon. CISESE = Centro de Investigación Científica y Estudios Superiores de Ensenada. UNAM = Universidad Nacional Autónoma de México.

- What are the effects of applying specific conservation practices?
- How do the socioeconomic situations of users influence the implementation of management practices?
- What is the best way to stimulate agricultural activities so as to minimize emigration?
- How can the political vision shift toward sound science-based decisions regarding natural resource management?

SELECTION OF WATERSHEDS

Numerous research and academic institutions met to select the watersheds to be included in the MEDS project. The institutions already have ongoing watershed projects throughout the country with different approaches and methods. The criteria for choosing watersheds were as follows:

1. The watershed should represent a process or regional problem with wide impact.
2. An integrated academic-scientific group should already exist in the region.
3. The site should require minimal additional instrumentation for monitoring purposes.
4. The site should preferably (but not indispensably) be located within natural protected areas by the National Commission for Knowledge and Protection of the Biodiversity.
5. The site should be of institutional interest.

6. The site should have reasonably easy access.
7. For equipment protection purposes, the site should have at least minimum security.
8. The scientific team should have interest in the development of young researchers.

Applying these criteria, 36 watersheds were initially selected located within the 13 administrative regions of the National Water Commission. Using the criteria 1, 2, 3, and 6, 13 of the watersheds were selected for scientific research purposes and the remaining 23 watersheds were selected for validation and technology transfer purposes. Figure 1 shows the location of the selected watersheds.

LINKING CEAP, WEBS, AND MEDS

The ongoing efforts in each North American Free Trade Agreement country provide a platform for building a multinational (North American) consortium on integrated water management. A number of opportunities for mutual benefit from collaboration exist (Sánchez Cohen et al. 2007).

Budget difficulties and accelerated climate change impacts will force countries and institutions to collaborate on multi-objective natural resource projects that benefit their population, their economy, and their health. In this endeavor, water will be the primary issue to address. The United States, Canada, and Mexico share

similar watershed problems that may be addressed by linking national efforts in a continental-scale North American watershed project. The overall aim would be to develop consistent data sets, apply similar simulation models, and apply the resulting understanding of watershed response to management through similar decision-support tools according to the capabilities of the institutions involved. Another advantage of this collaboration would be to optimize resources and avoid repetitive studies among watersheds.

REFERENCES

- Sánchez Cohen, I. 2007. Integrated Water Management in Climate Contrasting Watersheds in Mexico: From Research and Formation to Decision Taking. Durango, Mexico: National Institute of Forestry, Agricultural and Animal Husbandry Research in Mexico.
- Sánchez Cohen, I., G. Diaz Padilla, J. De Dios Benavides, J.L. Gonzalez Barrios, Philip Heilman, Roy Man, J. Estrada Avalos, and G. Gonzalez Cervantes. 2007. Integrated water management in Mexico: Building a framework for research. Paper presented at the 2007 Annual Conference of the Soil and Water Conservation Society, Tampa, FL, July 21–25, 2007.
- USDA Natural Resources Conservation Service. 2007. CEAP National Assessment. Washington, DC: USDA Natural Resources Conservation Service. <http://www.nrcs.usda.gov/Technical/NRI/ceap/assessment.html>.