

Integrating Social Science Research into the NSF CLEANER (WATERS) Network

CLEANER Project Office

**Social Science and Economics Committee
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New social science research is needed to support:

- Evidence-based design, enforcement and evaluation of policy
 - Use of advanced information systems to improve policy-based decisions and outcomes
- Assessment of human impact on the societal or economic value of natural and engineered environmental systems
- Assessment of the impacts of environmental modifications or remediation on social, biological and economic systems

Providing Inputs to Observatory Science Plan

at the earliest stages of research planning, where problems are framed and study boundaries formulated.

- **Ensure that information necessary for social science questions is included as a part of the monitoring system design, by**
 - collecting data through existing systems;
 - extending new networks for data collection; and
 - ensuring that data are effectively packaged for use by policy makers and other stakeholders
 - For example, to support scenario planning processes:
[Wisconsin Northern Highlands Assessment](#)

New Approaches for Accessing Data for Engineered Systems

- Landscaping and agricultural chemical use
- Urban streams and water distribution and sewerage systems
- Vehicle counts and VMT

Enabled through

- low cost sensors and instrumentation
- ubiquitous Internet access
- a large pool of active retirees and other potential citizen scientists

Social Science Research that Could be Enabled by WATERS

Broader Questions:

- Which human actions influence the availability of resources and disturbance regimes across aquatic and associated ecosystems?
- How do human-induced alterations to the environment lead to changes in ecosystems services?
- How do those changes in ecosystem services then affect humans and what we value?

Specific Topics:

1. Decision analysis for multi-attribute/multi-stakeholder problems
2. Development of national accounts that consider environmental quality and the valuation of ecosystem services
3. The formulation and support of market-based regulation for water pollution
4. Development of mechanisms for adaptive management.
5. The formulation of future institutional and design strategies for water systems

Topic 1. Decision Analysis Methods for Multiattribute/Multistakeholder Problems

Given that . . .

Multiple water uses dictate that tradeoffs are needed among (often) conflicting objectives.

Different groups, including farmers, those living in growing urban areas, municipal water managers, power suppliers, boaters, and conservationists, seek management options that maximize, or at least suffice, their needs and objectives.

Topic 1. Decision Analysis Methods for Multiattribute/Multistakeholder Problems (Cont.)

WATERS data and models can . . .

Help establish relationships between management options and outcomes for stakeholders, with reduced (and properly characterized) uncertainty.

Enable studies of how multiple stakeholder groups utilize (or do not utilize) scientific information and data in establishing their preferences and conducting their negotiations.

Providing an excellent laboratory for integrated studies of the physical, cyber-informational, and social-behavioral elements of environmental decision making.

→ Use of “decision theaters” or other decision support environments

Decision analysis can also help to identify the value-of-information for WATERS data and scientific advancements

Topic 2. Valuation of Environmental Quality, Ecosystem Services, and the Development of National Environmental Accounts (Green GDP)

- Support valuation studies based on . . .
 - Estimating the monetary value of ecosystem services, such as the support of aquatic life, climate regulation, nutrient cycling, and the maintenance of genetic resources;
 - The use of revealed preference, where the willingness to pay is derived from observed consumer behavior, such as the willingness to spend time and money traveling to recreational areas of high environmental quality; and
 - The use of stated preference or “contingent valuation”, where people are asked how much they would be willing to pay to preserve an environmental resource.

Topic 3. Market-Based Regulation

- In contrast to air pollution regulation, local hydrological mixing conditions and more complex socio-economic links to water quality have make development of emissions trading programs for water systems more difficult.
- Nevertheless, with sufficient data and modeling capabilities, effluent trading programs could support the reduction of water pollution at a net savings.
- WATERS data and models could provide support for water quality and quantity trading as part of Total Maximum Daily Load regulation, the regulation of various types of sewer overflows, and the management of water flows to support multiple uses including ecosystem services

Topic 4. Mechanisms for Adaptive Management and Risk Assessment

- Adaptive management is especially important in multi-use watersheds, such as the Klamath River Basin in northern California and Oregon, where trade-offs involve maintaining water flow for ecosystem purposes with water use for agriculture and other uses (<http://www.nrcs.usda.gov/feature/klamath/>).
- The integrated design of science and engineering data and social science data related to determinants of use and water quality would allow real-time assessment of decision inputs and management outcomes.

Topic 5. Formulation of Future Institutional and Design Strategies for Water Systems

Increasing regulatory costs and concerns over the availability of adequate water resources have heightened interest in non-traditional drinking water systems.

Distributed or decentralized treatment systems utilize both centralized and distributed technologies

Field and theoretical research is needed to study how decentralized treatment and dual water systems might be best implemented in US water systems.

Concomitantly, economics research is needed to determine the costs and their appropriate allocation for new system designs, as well as behavioral research to determine the public acceptance and likely modes of use (or misuse) of these designs.

Required Social Science Infrastructure and Data Sources

- Utilizing physical science sensor networks to observe human behavior and the aggregate environmental consequences of individual decisions
 - Monitor distributed environmental loads
 - Monitor environmental outcomes, such as swimability and fishability, allowing water quality outcomes to be linked to social and economic values
- Enhancing traditional social science data collection tools and social science community data structures
- Conduct environmental risk perception and valuation cohort studies

Coordinate with NSF SBE/CISE Initiative on Cyberinfrastructure for the Social Sciences

“Cyberinfrastructure can help the social and behavioral sciences by enabling the development of more realistic models of complex social phenomena, the production and analysis of larger datasets (such as surveys, censuses, textual corpora, videotapes, cognitive neuroimaging records, and administrative data) that more completely record human behavior, the integration and coordination of disparate datasets to enable deeper investigation, and the collection of better data through experiments and simulations on the Internet.”