ENVIRONMENTAL MANAGEMENT AND WATER QUALITY AND QUANTITY

M. Mehallis
Center for Information Transfer, and Environmental MBA Graduate Program, Florida Atlantic University, USA

Keywords: environmental management, water quality, management mechanisms, geographic parameters, global issues,sustainable development

Contents

Summary

All of these case examples of sustainable development have several common elements. These elements include: decentralized locus of control, the integration of natural systems with management systems, public participation, information and decision making access and authority shared by stakeholders creating a sense of ownership, adequate infrastructure support, and development of mechanisms to encourage water managers' participation with private industry.

1. Environmental Management

The trend at the end of the 20th century is to specialize and to integrate steering mechanisms via networks. Environmental management has been defined as encompassing "those activities which enhance beneficial links and minimize adverse links amongst resource systems and their environments and which seek to attain desirable environmental system states in response to community perceptions and desires, under prevailing socioeconomic and technical conditions." In other words, environmental management is the management of the ways in which society uses, or manages, the environment in a sustainable way. Environmental management encompasses the social, economic, political, and biophysical environments. It is a dynamic process which is action-oriented and implemented by means of policies, regulations, monitoring systems, strategies, and action plans for accountability.

The seeds of environmental management were an unplanned, or spurious, by-product of the Industrial Revolution. As economically developed countries embraced industrialization, e.g., Ford Motor Company's assembly line production concept, the upper classes of society had land set aside (by statute) for "nature and scientific pursuit."

Increased urbanization, i.e., people leaving rural regions to live in cities and enhance their economic standing with industrial jobs, ultimately leads to prosperity and a better quality of life. However, initially when urbanization occurs, there tends to be a decline in living conditions. Rapid flight from pastoral settings to cities places stress on the urban infrastructure. The time lag between the appearance of rural-to-urban migrants and the growth of infrastructures (sanitation, waste, garbage, river and air pollution, and water quality) to deal with urban populations generally is much too long.

The world population generally is moving from rural areas into urban cities as developing nations continue to emerge. The aggregation into cities creates an imbalance in the natural systems. Declines occur in water quantity and quality as well as declines in air quality. Increases result in pollution of the environment with significant rises in noise pollution, i.e., the industrial background noise of a city's infrastructure operations.

Large-scale mining projects flourished in the first half of the 20th century. Unfortunately, they produced many health and environmental problems. Health departments and public health acts are response mechanisms which were developed to repair the damage created by mining, heavy industry, urbanization. Similarly, architects began to develop "green space" and aesthetically pleasing structures for inhabitants. Unfortunately, it has taken longer for architects to develop "environmentally appropriate" structures, and, yet, they are ahead of most other groups in these efforts.

The impact of World War II resulted both in accelerated damage to the environment and also in accelerated development and use of technology. In addition, when the war was over, people who had faced the life-threatening experience of war reassessed their lives, life quality, and values. One   result was the conceptual expansion of Western law to societal values for improved economics and standards of living. This led to the comparative analysis of the value of development to society in relation to the impact on health and the environment.

Technological changes led to advancements in environmental science in the fifties and sixties. With enhanced telecommunications, people in various parts of the world could begin to see events from great distances. This technical advance enabled individuals in the sixties and seventies to view firsthand the ravages against the environment. For example, birth defects resulting from mercury discharged by careless factories (e.g., Minimata, Japan) could be "seen" by millions. While locals could personally see the Monongahela River on fire in Ohio as a result of chemical dumping, millions across the world could see it, too. So the negative impacts of "cause-and-effect" of unregulated, unconcerned industry were "brought home" virtually into society's living room.

In the Western World, Rachel Carson's book that was released in 1962, *Silent Spring*, led to debates on environmental issues. Concerned citizens began to notice the environment and began to make provisions for its preservation. Water resources management, while not a new concept, came into its forte in this period of environmental management recognition, i.e., the acceptance that the environment, especially water, was a finite commodity which needed to be managed.

The public awareness of environment and the need to manage it, led to drastic changes in that management. In the early stages of water resources management, governments initiated the management policies. Since they were in charge, they controlled the water resources by determining who and where businesses could operate. The controlling mechanisms for this were leases and licenses. This was true for all natural environmental sectors (e.g., water, public lands, etc.) except forestry and fisheries. Forests and fish are renewable resources and have been managed as such. Generally there were no agreements or legislated environmental criteria or standards. Even for the meager few which were in existence, the governments did not enforce them.

In the United States, the Vietnam War era led to another re-assessment of values by the younger generation disenfranchised by the war. This generation (the "baby-boomers" born of parents returning from World War II) began to revere the preservation of nature and natural systems. These values have been seized upon by the business world in the

last quarter of the 20th century and resulted in the growth of "natural foods," "natural cosmetics and toiletries," "biodegradable cleaning products," etc.

Assessments to determine the state of the environment and the potential impact of new development resulted in regulations requiring environmental impact assessments prior to approval to begin development. This approach more clearly pointed out the need to monitor changes in the environment, the underpinning need to collect reliable, consistent, credible data, and to design information systems which could enable decision makers to make sound decisions. Water resources vary spatially, in time, qualitatively and quantitatively. So the recording and management of these resources must be maintained in a spatial context, as well.

Focus was shifted in the sixties and seventies away from attempting to manage the environment (not readily controllable) to managing society's use of environment. This paradigm shift was formally endorsed in 1972 at the Stockholm United Nations Conference on Human Environment. This political endorsement placed environment on the international agenda. In summary, environmental management was society's response to the increasing world population and its incessant demands on natural resources. Public awareness of the consequences of increasing development led to more public participation in environmental issues.

Locus of control over time has gone from the centralized government control to a more decentralized state or local control. Differences still appear between developed and developing nations. The developing nations generally have maintained strong, centralized control. Even if the governments wish to decentralize, they are unable to, because they do not have, nor can they afford to get, the required infrastructure for managing a decentralized system. Developed nations have found that decentralization makes environmental issues much more manageable. While states/provinces have been in the control position, there is a shift now towards integrated river basin management and even to micro-basin management. This shift is very meaningful, because it brings the defined unit of management into harmony with the natural environmental system. The holistic natural unit based approach of information analysis, management, and assessment is preferable. A paradigm shift has placed emphasis on subsectoral development based on demand predicated on subsectoral management of the sector.

Universally accepted principles are contained in the Dublin Principles Agenda 21, the Global Water Partnership (GWP) and the World Water Council (WWC), the Declaration of San Jose, and the Bolivian Summit Declaration. According to the InterAmerican Development Bank (IDB) instrumental strategies as applied in 1999 include cost recovery, capacity development and human capital, innovation and reform of institutions, participation in reform, stakeholder participation, decentralization (placing the locus of control at the lowest possible level), stakeholder participation, participation of the private sector, transfer of water rights, and the establishment of river basin organizations. The strategies are analyzed by their context and the level at which decisions for action are taken. These levels may be operational, organizational, or constitutional. The IDB is attempting to implement institutional management change so that nations form basin committees that are comprised of microbasin organizations at the local, municipal level.

2. Who is Responsible for Environmental Management?

The general model employed for management includes: the organization/administration, plan for management action, direction, monitoring and control. Responsibility for environmental management falls to national, state/province, and local governments and, more recently, to industry/business.

2.1 National Governments

At all levels (local, state, province, national) governments provide the legal basis for management. Constitutional powers of government include:

- External affairs
- Foreign investment
- Trade and commerce (domestic and international)
- Taxation
- Funding grants
- Navigation.

These are implemented through statutory mechanisms. Those may include statutes, such as the Environmental Protection Act (EPA), the Endangered Species Act, National Parks and Wildlife Act, Protection of Seas Act, and other anti-dumping, fishing, etc; legislation in addition to formal laws, non-statutory mechanisms are used. Non-statutory mechanisms are non-legally imposed policies and include those adopted on reducing Greenhouse Gas Emissions 20 percent by the year 2005, coastal management, oil spills, pollution, waste disposal, etc. Often non-statutory mechanisms use incentives to obtain compliance. International agreements are made among governments but have not had a governing unit to provide sanctions for non-compliance to agreements until very recently. Examples include the International Convention on Regulation of Whaling and the Montreal Protocol. The World Trade Organization (WTO) has been established as a court to hear disputes over transboundary, international trade issues. Hopefully a similar organization will be developed to oversee environmental/water resources management issues in the near future.

2.2 State/Provincial Governments

State/Provincial governments focus their energies on state/province centered environmental issues for management. Examples from the United States are the Mine Act, Environmental Protection Act, Conservation and Land Management Act, and Fisheries.

2.3 Local Governments

Local governments tend to create agreements by consensus with stakeholder buy-in which are not legally binding. They are not legally binding because of the way in which they are framed and ratified (not through the formal legal process). In addition, there is no high court to resolve disputes, which may arise. Local governments can, however, develop standards for land use by passing zoning laws. These laws establish the purpose

for which land can be used; e.g., residential, commercial. Additionally in the U.S., municipalities establish easements which belong to the city. These enable the water, electric, and phone companies complete access to pipes and lines. So, repairs can be managed more easily.

2.4 Industry

Industry uses environmentally sensitive methods to comply with legal requirements. Business management is focused on increasing profits. Adding environment to the mix has been seen as a necessary evil in order to comply with government regulations and requirements. Efforts are under way to expand that perspective into using environment to develop distinctive competence and ultimately competitive advantage. Industry must accept responsibility for environmental business management because it controls the capital which can make it happen.

2.5 Non-Governmental Organizations

Non-governmental organizations (NGOs) are groups or institutions that are entirely or mostly independent of government and who have primarily environmental rather than commercial objectives. An example of a very effective NGO is in Brazil.

The Brazilian project, "Adopt a Watershed," was one of the strategies used by the Secretary of Water Resources (Ministry of Environment, Water Resources and Legal Amazonia - MMARHAL) to add public participation to the process of planning the Brazilian watersheds, started in 1997. It was directed toward professors in universities and their students. Through them, communities in small watersheds would be invited to adopt their watershed through a process of understanding it, being aware of the damages of human action in it and participating in debates/activities regarding the quality and quantity of water. Sometimes, the debates began through heath or employment issues, which were relevant issues to the people. The scope of the project was to build together (professors and community) an Action Plan for the small watershed, by building a vision for the future and the steps needed to achieve it. Many communities were "touched" by this project: 70 universities, 112 watersheds (secondary rivers, lakes, underground water) in 10 states. The mayors were involved by giving local support for the project. The Ministry provided scholarships for students and professors as paid for materials and travel expenses. Although there have been budget cuts, many projects are still working because of: (1) the involvement of the professors and the community in real issues; (2) other sponsors who were found by the professors to continue the research/outreach activities; (3) NGOs' involvement in the process. As a result, (1) many events were held during the time span involving the community in general, (2) much research was conducted on the potential of the regions, especially with maps; and (3) many meetings were held although outcomes have not all been demonstrated.

This organization works to bring forward general populist interests with regard to management of water resources. Similarly, the International Union of Conservation and Nature (IUCN) plays a role in developing and implementing community-based management in developing countries. They raise money from the private sector to facilitate public participation, educate of the general public, and plan strategies.

Generally NGOs gather diverse groups of people and focus their activities on common goals.

3. Management Mechanisms

Water resources management can be accomplished through various mechanisms. These mechanisms are based on agreed upon policies and formally established on geographic parameters. Generally there is a tension between political and natural systems.

3.1 Policy Formulation

3.1.1 Statutory Mechanisms

Statutory mechanisms are those legislated by government bodies.

(a) Legislatures establish laws, policies, and standards for water allocation and minimally acceptable quality. The purpose of these mechanisms is to ascertain that ecological processes which are essential for maintaining biodiversity continue so that sustainability is ensured.
(b) Statutory acts, such as the Environmental Protection Act (EPA), are legal statements requiring the implementation of actions, policies, and management guidelines. Generally there is some sanction, or punishment, for non-compliance to the law.

3.1.2 Non-Statutory Mechanisms

Non-statutory mechanisms are those not written in the law but which are considered mutually agreeable policies.

(a) Education policy can be extended to develop public awareness about managing water resources and quality.
(b) Land use policy can be applied so that the quality and availability of water is maximized.
(c) Planning policies used by industry in general can be "water sensitive " so that water consumption is reduced enabling efficient and effective uses. An example is the use of recycled water to hydrate soccer fields or other lawns rather than the use of potable water, which can be conserved for human consumption. Some businesses have installed faucets which turn off automatically so that potable water doesn't needlessly literally run down the drain. Many older municipal water systems, especially in South America, lose a great deal of potable water from leaking pipes. For example, Hidrocapital in Caracas, Venezuela, has estimated that thirty-five percent is lost from leakage. Those pipes could be placed on a renewal cycle, so they are systematically replaced in a timely fashion prior to springing leaks.
(d) Agenda 21 is an action plan for sustainable development for the world in the 21st century. It was drawn up at the United Nations "Earth Summit" in Rio de Janeiro, Brazil, in 1992, at a gathering of 179 heads of state and government. There are many definitions for "sustainable development," but a good one is meeting the needs of the present without compromising the ability of the future generations to meet their

needs. In other words, "sustainable development" is a process of social and economic development that can be sustained, not one that will ruin the future.

4. Geographic Parameters

(a) Catchment management allows for natural system management using water catchment basins as the unit to be managed. The natural system emphasizes the importance of the hydrological cycle of water. This integrated view of rivers along with the economic appraisal of the hydrological cycle system is documented by Yukata Takahasi, Professor Emeritus at the University of Tokyo, in his paper on " The New Concept in Water Management in Japan: Towards a Sound Hydrological Cycle within a Catchment Area" presented at the II. Encuentro de Las Aguas (Water Meeting II) in Montevideo, Uruguay (June 15-18, 1999). Catchment management enables the astute manager to observe changes in social structure, potential increase of flooding, and water contamination from severe urbanization; increased damage potential (drought, erosion) from water shortages; and to take preventive and/or corrective measures.

(b) Physical structures, such as dams, can be employed to control geographic parameters. Managers need to ascertain the long-term effects of their interventions in the hope that the "cure" toward better management of water resources does not result in the opposite. An example of the latter can be seen in Florida's Kissimmee River where the U.S. Army Corps of Engineers removed the meanders in the river with the intent of providing greater water quality by the Kissimmee Canal downstream. Thirty years later, it has been determined that the removal of the meanders had a detrimental effect on the entire hydrologic and ecological systems. Now the US Army Corps of Engineers has embarked on a $400 million project, which will replace the meanders in one-third of the River and will take approximately a decade to accomplish.

Increased modernization of societies generally has resulted in degradation of water resources. Pastoral activities have increased to provide the food necessary for urban society. With this increase in volume, riverbanks become eroded, land is cleared and often becomes degraded. Saltwater intrusion can occur along with ground water contamination by industry. Runoff from fertilizers or cattle has led to deaths from ebola bacteria contaminated waters. The habitats for flora and fauna are often compromised and result in general environmental decline. Species whose habitats are destroyed may become extinct or mutate to altered states. These changes impact the biosphere and the natural systems upon which human health is predicated.

The World Resources Institute (WRI) is beginning to work with corporations and with colleges of business to turn this situation around so that environment can be viewed as a strategic advantage. An example of such a program can be found in the College of Business at Florida Atlantic University in Boca Raton, Florida. The program, the Environmental MBA Program, provides a means for fulltime working professionals to complete the MBA with a specializaion in environmental business management in 15 months with weekend classes (once every 3 weeks) and Distance Learning. The purpose is to teach environmental business management and how to use the environment to define a competitive advantage.

-
-
-

TO ACCESS ALL THE **22 PAGES** OF THIS CHAPTER,
Visit: http://www.eolss.net/Eolss-sampleAllChapter.aspx

Bibliography

Bartelmus, P. (1994). *Environment, growth, and development: the concepts and strategies of sustainability*. New York: Routledge.

Commission for Environmental Cooperation (1999) *Assessing Environmental Effects of the North American Free Trade Agreement (NAFTA)*. An Analytical Framework (Phase II) and Issue Studies. Scan Express, Canada.

Conacher, A. (1987) *Resources and environmental management: some fundamental concepts and definitions*. Search 9.

Decock, Paul (1994). *Privatizaciones: Panaramica de un Team de Actualidad (la Parte)*. Second International Course on Economic Reforms and Public Strategic Management. Sanitago, Chile, Sept-Oct. 1994.

Dialogue, III, InterAmerican Water Dialogue, Republic of Panama, March 1999

General Secretariat of the Organization of American States (1998). *Development of an Inter-American Plan of Action on Water Resources Management*. In Status and Proposed Actions to Continue the Implementation of the Initiatives on Water Resources and Coastal Areas of the Plan of Action for the Sustainable Development of the Americas. CIDI, 1999.

Israel Agritech (1999). *Agriculture in Israel*. [Online] Available from: http://www.israel.org/mfa/go.asp?MFAH00170 [6/4/99].

Krueger, Richard. (1988). *Focus Groups: A Practical Guide for Applied Research*. Sage Publications, USA.

Masera, Oscar and MacLaren, Virginia (1996). *NAFTA's Environmental Effects: Dimensions and Indicators of Environmental Quality*. NAFTA Effects Working Paper Series, Working Paper No. 5. Montreal Commission for Environmental Cooperation [April].

Mexican National Water Commission (NWC) (1999*). Comicion Nacional del Agua* [Online]. Available from http://www.can.gob.mx/hmcnal.html [5/28/99].

Neveau, Giles (1999). *Keynote Address*. Water Information Summit. Fort Lauderdale, Florida, October 4, 1999.

The Green Lane (1997). *Montreal Protocol Summary*. Environment Canada's World Wide Web site. [Online]. Available from: http://www.ec.gc.ca/ozone/Mont_opp/montsumm.htm

Turrent (1997). *Distribution of Total Water Consumption in Mexico*. In Commission for Environmental Cooperation, 1999. Canada, Scan Express.

United States Geological Survey (1998*). Center for Integration of Natural Disaster Information*. USGS Fact Sheet 166-98, December 1998. [Online]. Available from http://cindi.usgs.gov

United States Geological Survey (1999). Sediment – Contaminat Data Base [Online]. Available from: http://www.umesc.usgs.gov/data_library/sediments_contaminants/qa-index.html

U.S. Department of Agriculture (1994). Industrial Uses of Agricultural Materials, Situation and Outlook. Commodity Economics Division, Economic Reaearch Service. 1US-3 Washington, DC: US Government Printing Office.

Water Research Institute (1998). *Information Center Water Research Institute – Technion, Israel.* Available from: http://www.wri.technion.ac.il/ [2/10/99].