INTEGRATED WATER RESOURCES MANAGEMENT CONCEPTS AND ISSUES

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Abstract

There is growing awareness that comprehensive water resources management is needed, because:

1. fresh water resources are limited;
2. those limited fresh water resources are becoming more and more polluted, rendering them unfit for human consumption and also unfit to sustain the ecosystem;
3. those limited fresh water resources have to be divided amongst competing needs and demands in society
4. many citizens do not as yet have access to sufficient and safe fresh water resources
5. it is increasingly realised that there is a huge potential to increase crop production and achieve food security through more efficient use of rainfall through improved soil and water conservation and harvesting techniques
6. structures to control water (such as dams and dikes) may often have undesirable consequences on the environment
7. there is an intimate relationship between groundwater and surface water, between coastal water and fresh water, etc. Regulating one system and not the others may not achieve the desired results.

Hence, engineering, economic, social, ecological and legal aspects need to be considered, as well as quantitative and qualitative aspects, and supply and demand. Moreover, also the 'management cycle' (planning, monitoring, operation & maintenance, etc.) needs to be consistent.

Integrated water resources management, then, seeks to manage the water resources in a comprehensive and holistic way. It therefore has to consider the water resources from a number of different perspectives or dimensions. Once these various dimensions have been considered, appropriate decisions and arrangements can be made.

Due to the nature of water, integrated water resources management has to take account of the following four dimensions:

1. the *water resources*, or the natural dimension, taking the entire hydrological cycle into account, including stock and flows, as well as water quantity and water quality; distinguishing, for example, rainfall, soil moisture, water in rivers, lakes, and aquifers, in wetlands and estuaries, considering also return flows etc.
2. the *water users*, the human dimension, all economic interests and stakeholders
3. the *spatial scale*, including

- the spatial distribution of water resources and uses (e.g. well-watered upstream watersheds and arid plains downstream)
- the various spatial scales at which water is being managed, i.e. individual user, user groups (e.g. user boards), watershed, catchment, (international) basin; and the institutional arrangements that exist at these various scales

4. the *temporal scale*; taking into account the temporal variation in availability of and demand for water resources, but also the physical structures that have been built to even out fluctuations and to better match the supply with demand.

Integrated Water Resources Management therefore acknowledges the entire water cycle with all its natural aspects, as well as the interests of the water users in the different sectors of a society (or an entire region); hence it addresses both the natural and the human dimensions of water. Decision-making would involve the integration of the different objectives where possible, and a trade-off or priority-setting between these objectives where necessary, by carefully weighing these in an informed and transparent manner, according to societal objectives and constraints. Special care should be taken to consider spatial scales, in terms of geographical variation in water availability and the possible upstream-downstream interactions, as well as time scales, such as the natural seasonal, annual and long-term fluctuations in water availability, and the implications of developments now for future generations.

To accomplish the integrated management of water resources, appropriate legal, institutional and financial arrangements are required that acknowledge the four dimensions of IWRM. In order for a society to get the right arrangements in place, it requires a sound policy on water.

The International Commission on Water Resources Systems (ICWRS) of IAHS wants to promote research development on the inter-connectedness of both biotic and abiotic components of water resources systems and, by extension, on the integration of all the phases of water resource protection, planning, design, management, operation and utilization. In this way the mutual dependence between sustainability and integration becomes a guiding principle for the ICWRS's planning activities. This integration challenge should be interpreted very widely:

1. Recognition of all dimensions of water resources,
2. Integrating hydrological sciences,
3. Raising the profile of the human factor in Hydrology,
4. Systematizing information.

In sum, the strategy of ICWRS mirrors the world-wide discussions about the future of water management in a changing world. The more comprehensive look on these problems and the interdisciplinary approach offered by ICWRS will ensure a leading role of IAHS in this field of science.