Ecology Meets Hydrology

New Conceptions Pave the Way for Hydrosolidarity

What is ethical behavior? One definition says that it is to know what is right and wrong, and to act automatically according to principles and embedded values.

When, however, fundamental maxims, visions and principles are under evaluation, and a new orientation or awareness arises, then one can confidently speak of a change in ethics.

According to Professor Malin Falkenmark, senior scientist at the Stockholm International Water Institute, and Professor Carl Folke, of the Systems Ecology Institution at Stockholm University, this can certainly be applied to what currently is required in water resources management.

Out With the Old, In With the New

In the early 2002 issue of the journal *Hydrology and Earth System Sciences,* Professors Falkenmark and Folke present a variety of new conceptual approaches towards a secure water future – approaches that require a profound shift in thinking and a discarding of traditional scientific concepts.

From the hydrological point of view, conventional water concepts have focused predominantly on visible water, i.e. water as a resource to be used in society. Indirect use of water (for instance in plant production) and hidden functions (water as a mobile solvent) have since long been neglected. In this context the blue/green water concept is extremely important, as is the realization that in regions with high evaporative demand, any land use changes may produce clear changes in the available blue water.

From the ecological point of view, conceptual development is also required. It is no longer acceptable to differentiate between ecology and humanity and consider both parts as independent actors. The deep involvement and multiple roles water plays both within the anthropogenic world and the non-human natural world provides a ground for conflicts over priorities and goals which need to be united to reach sustainability.

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An essential point, according to Falkenmark and Folke, is that poverty eradication will involve land and water use changes and that humanity therefore will have to live with ecosystem change and to consider this change as being normal. The philosophy of the past was assume stability and manage change. A more modern and truthful maxim is to live with change and manage for securing stability.

Ecosystem Resilience as an Elastic Band

Why are ecosystems under change? The process of natural succession plays a large role, but in order to satisfy human needs, humans have to manipulate the landscape. These induced, unnatural changes (water supply for household and industry and energy production, food and timber production, output of waste, etc.) are those challenging the ecosystem resilience. Resilience is the capacity of an ecosystem to tolerate disturbances and sudden effects before moving from one stable state (for instance a tropical forest or a coral dominated reef) to another stable state (tropical grassland or macroalgae dominated reef).

Generally, the more diverse the system is, the better it copes with disturbances. The challenge is that human landscape manipulations, both the direct manipulation of water flows and quality and the indirect ones of land and vegetation, need to respect the ecosystem capacity to sustain the life-support systems in the area under manipulation. Here, ethical behavior involves an instinctive and obvious respect for crucial ecosystems' capacity to produce essential ecological goods and services.

Multiplayer Instead of Single Expert

This respectful approach is extremely important for decision making in a whole catchment. Landscape manipulations have side effects which can act against future de-

velopment of the region. Catchments are useful spatial units in which different manipulations and side effects can be predicted. The challenge is to cope with the entire gamut of needs: water needs, land use needs, and terrestrial and aquatic ecosystem needs (and the goods and services that they provide).

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To reconcile conflicts of interest, a solidarity-based balancing of human livelihood interests against unavoidable environmental consequences needs to be achieved. It is evident that in this situation the past one-thing at-a-time approach is of limited value. Interdisciplinary competence and know-how are required, something which current scientific education does not especially encourage today.

The Concrete Management Approach

To know how to most appropriately protect crucial ecosystem processes and guarantee a sustainable life-support system, the relevant water-related aspects have to be identified and understood, since they indicate the way in which ecosystems may be disturbed by water management or mismanagement. These aspects include water flow, water pathways, flow seasonality, water table, chemical characteristics, etc.

Such knowledge does not, however, enable one to avoid comprising. What they do is help guide the balancing of incompatible interests in a catchment. Freshwater management does not only refer to economic needs within industry, households or irrigation. In order to maintain all water-dependent resilience within the catchment, sufficient amounts of freshwater also need to be allocated to both aquatic and terrestrial ecosystem processes and functions that secure essential ecological services.

It is here that the interdisciplinary multiplayer faces a key challenge. The fundamental concept to consider is the blue/green water concept.

In short, all land use and terrestrial ecosystems are green water related, while current traditional water management is blue water related. Catchment water management, in fact, should actually be management of the whole rainfall over the catchment, with proper attention to blue and green water flow. Needed now are ethical principles that focus on interactions and processes, and that are related to the unavoidable changes (rather than protecting the current state).

The Politics of Time – Need for a New Perspective

A relevant consideration for political promises and hopes is the aspect of time. A political effort and campaign to demonstrate a successful management concept today is far too effect-oriented rather than cause-oriented. But even for effect demonstrations, the projected time scales are far too short. A water body with a water exchange rate of 25 years, such as the Baltic Sea, requires about three times as many years before profound measures show a prevailing effect in the whole water volume. Political goals being set today need to consider these often highly delayed time scales.

What is Science?

Probably the most important fundamental precept to debase is the conception of science as a whole. The new conceptualization has to compensate for a number of current weaknesses inherited from earlier phases of scientific development. The most basic one is the tunnelvision that goes with the organization of science which is inherited from the great philosopher Descartes' conceptualization in the 17th century, which distinguishes between different aspects of the same reality (physics, chemistry, biology, etc).

Problem and whole process-oriented disciplines would allow for a more integrative approach. But there are also weaknesses in the conception of water as a land attribute, rather than a flow passing through the plant and vanishing to the atmosphere. The duty of the scientific community is to develop concepts for understanding a world that is changing more rapidly and at larger scales than previously in human history.

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And apart from the current paradigm for scientific quality evaluation, which has a strict and sometimes tunnel focus on "doing things right", critical attention has to be paid to "doing the right thing". ■

The article, by Mrs. Stephanie Blenckner of SIWI, is based on "The Ethics of Socio-ecohydrological Catchment Management" by Professor Malin Falkenmark of SIWI and Professor Carl Folke of Stockholm Univerisity. Their article is published in the issue 6(1), 1-9 (2002) of *Hydrology and Earth System Sciences.*