

have access to the competence needed to produce high quality solutions, which will not only solve the immediate problems but contribute effectively to the overall socio-economic development within the basin. By having the power to veto and to monitor all developments in the basin, these committees could also contribute to reduce the level of corruption.

#### Management components

- *Strong regulation* is an important element in controlling pollution and over-extraction. But to be effective, the regulators need to be independent (and to have the government support for this independence), have access to adequate investments to carry out their function, and be able to regulate both public and private organisations and to make maximum use of the internationally available and appropriate benchmarks.
- *Politicians* have to be convinced of the need to change – no easy task since they are frequently rich industrialists with an interest in preserving the status quo.
- *Inter-basin* transfers will continue to be a necessary part of managing basins which are subject to a high level of industrial and urban development. However, such transfers should not be decided purely by the national bureaucracy and should be seen as being an interim measure prior to management improvements in the importing basin, ultimately leading to self-sufficiency. Where such transfers take place they should be subject to *fair compensation* for the exporting basin.
- An *increased emphasis on "green consumerism"* in the Western world should be encouraged, adopting similar campaigns as the ones to discourage child labour and sweat shops. Western consumers would demand environmentally friendly production, and would pay an extra premium to be remitted to the pollution prone producers for investments in cleaner production and sophisticated treatment technology.
- There is a great need for improved *exchange of information and knowledge* among international networks, particularly within the Southern hemisphere. It seems that most problems have been solved somewhere, somehow and by somebody. However, this is not well documented nor is access to these solutions easy. Moreover, many solutions may need some adaptation to the local situation. "*Scan globally – re-invent locally*". ■

# Towards Familiarity With Uncertainties



Photo: Jan Lundqvist

Different water needs and uses are often incompatible with each other. They require trade-offs and decision making which are guided by a proper understanding of alternatives and their consequences, particularly their effects on people.

**A SIWI Seminar on August 16, 2003, put focus on how scientific effort could be better tuned to exercise influence on decision making. The seminar was a first effort to identify and analyse the significance of uncertainty and ignorance about natural systems as opposed to societal systems. How can uncertainties be addressed on the road towards increased hydrosolidarity between upstreamers and downstreamers, between land use and water, and between human needs and the safeguarding of crucial ecosystems?**

#### What we know and what we do not know

History is full of disastrous errors due to uncertainty and ignorance of cause-effect relationships both in natural and socio-economic sciences. What we know may be disregarded, and what we do not know may give rise to unpleasant surprises. Incompatible water needs require trade-offs and wise decision making, guided by both proper understanding of alternatives and their consequences, and by a vision of hydrosolidarity. In a catchment, water-

related biophysical linkages interconnect all consumption and production activities and the consequences of human activities for the ecosystems.

Without knowing cause-effect relationships, political decision making is both poor and error prone. Scientists have therefore an important role to play in explaining, convincing and anticipating and in interdisciplinary bridge-building. Their guidance has to be based on familiarity with relationships and uncertainties: risk in relation to coping with droughts and floods; uncertainty in relation to data-poor situations; indeterminacy in relation to complex real world catchments; general ignorance, etc.

#### Different types of uncertainties

The seminar started with an overview by Professor Poul Harremoës of different types of uncertainty involved in water resources management issues. He distinguished between uncertainties on the one hand, and total ignorance on the other. He furthermore differentiated between three



Uncertainty and ignorance of natural systems may end up in a closed road in many aspects.

different origins of uncertainties: statistical uncertainty or risk; scenario uncertainty; and indeterminacy in terms of recognised ignorance. The seminar proceeded with illustrations of these different types for natural systems, on the one hand, and societal systems on the other.

Four examples were offered on uncertainty and ignorance in natural systems. The first put focus on the total ignorance about long-term effects of land-use generated water balance changes in Australia and the massive environmental problems that followed. The second discussed scenario uncertainties that still make riverine water quality indices difficult to predict. A slightly different case was presented from India, where severe ignorance problems still impede water pollution abatement due to a religious belief that rivers remain clean despite pollution. Finally, the approaches

in USA and Europe to what is known or unknown were illustrated by the case of radically different policies in response to the hazardous gasoline additive MTBE.

For societal systems the focus was even more heterogeneous. One issue discussed was the possibility for Northern customers to influence the environmental debt of textile industries in poor countries, and the complications caused by ignorance about the consumer preferences that influence clothing business. Another issue referred to the difference between perceived and real risk of the two parties in Middle East water negotiations. Difficulties in defining the true value of water by lack of distinction between benefits from water itself on the one hand, and the location in a catchment from where the possibility to generate that benefit originates were also presented.

### Management of uncertainty

After these different illustrations from the natural and societal sectors, three examples were given on how to manage uncertainty and ignorance. The first addressed the possibility to increase creditworthiness by reducing the economic risk of an investment introduced by ignorance of water behaviour, of water as a binding constraint, or of water functions in producing environmental effects of an economically supported activity. Another case raised the issue of multistakeholder participation in basin committees, stressing the importance that the technical rules be properly understood by the parties, in order to allow trade-offs that are both understandable and socially acceptable. The third example highlighted some aspects of uncertainty and subdefiniteness of relevance for the development of two Siberian river basins.

In the general discussion, the issue was raised what the researcher, given all these uncertainties and ignorances, can do to help policy making towards better founded decisions. The seminar had clarified the very different types of uncertainties that have to be responded to in natural systems as opposed to societal systems. The former involves besides climatic variability, lack of data and complexity also uncertainties involved in cause-effect predictions. In society, on the other hand, there is the fundamental challenge of working with very different perceptions among stakeholder groups. One has also to remember that for the policy maker the notion of risk may be clearly preferable to uncertainty or vulnerability. In his decision making, the policy maker has moreover to seriously consider political risks of a more scientifically based decision.

### The cultural and ethical perspective

A final observation was that the issue of dealing with what we don't know is particularly difficult in the Western world because of a positivistic thinking, based on reliance on "facts", inherited as part of the dominating culture. Approaches to risks may also include denial: not admitting them or not wanting to hear about them. For the decision maker, there is finally the fundamental choice of decision/no decision: on the one hand making decisions in full awareness of existing uncertainties (precautionary principle), and on the other postponing decision while waiting for better information (allowing the problem to exacerbate in the mean time).

Whether to emphasise or de-emphasise hidden uncertainties should basically be seen as an ethical issue. ■