# MAIN FINDINGS OF THE INTERNATIONAL WORKSHOP MONITORING TAILOR-MADE III - INFORMATION FOR SUSTAINABLE WATER MANAGEMENT

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## INTRODUCTION

Monitoring Tailor-Made III is the third international workshop on strategies and practices to design, implement and report monitoring programmes which render information on aquatic resources. This third workshop put emphasis on information for sustainable, integrated water management. Integrated water management takes economic, ecological and societal issues into account and requires thus information on the status of aquatic resources in relation to the economic and societal issues. Frequently, many data are available for all of the issues. Nevertheless, policy-makers perceive the information available as inadequate. A framework is required for the aggregation of data from the different disciplines and for information which can underpin integrated water management. Such a framework information-architecture is needed which enables meaningful aggregation of data of the different viewpoints to be made and which allows trade-offs between economic, societal, and ecological dimensions to be evaluated. The conceptual technical elaboration and implementation of such a framework is a challenge facing all environmental managers today.

Exchange of knowledge and experiences is essential to further develop the quality and accessibility of information. The workshop Monitoring Tailor-Made provides a platform for an active and effective interchange of ideas and practices. The first and second Monitoring Tailor-Made workshop focused on information and the role of monitoring in it. Monitoring Tailor-Made III continued this general theme with a specific theme of: how to assemble integrated information to support sustainable water management. Four levels of integrated information are distinguished: integration of science, policy-makers and the public; integration of different scientific disciplines in the domains of natural and socio-economic sciences; integration on a spatial scale; and integration of measurement and data-treatment methodologies within the domain of the natural sciences. The main findings from the presentations and discussions during the workshop Monitoring Tailor-Made III are presented in this paper.

## INTEGRATED WATER ASSESSMENT

Monitoring is used to assess the quantity and quality of water and is often linked to legal instruments to regulate the use of the water body. The growing importance of diffuse pollution makes common monitoring practices less suitable as a policy instrument, as Russell shows us in his paper; but also makes a good classification of waters far more complex than a single-sample exercise, as Ward shows in his paper. All in all, an integrated approach to assessing water bodies is needed.

A wide range of definitions for integrated assessment have been used during the workshop. From the various presentations one can conclude that integrated assessment implies integration of at least the following:

- Information from different countries and authorities;
- Different disciplines such as biology, chemistry, economics, etc.;
- Different types of information. An example of this is the D-P-S-I-R (Driving force - Pressure - State - Impact - societal Response) approach.
- Models, remote sensing & monitoring;
- Data (through aggregation): basic data are transformed into indicators.

This range of definitions indicates that the integrated assessment concept itself and/or the use of this concept needs to be sharpened. However, various characteristics of integrated assessment have come to the fore. Integrated assessments should include:

- *Multidisciplinary teams with scientists applying holistic approaches.* Scientists from the social, economic and natural sciences should work together on the issues, each being aware of having blinkers that may hinders the full view of the issue.
- *Communication.* Special emphasis on communication within and between parties and for dialogue with policy-makers. This communication is essential in information production process and specification of information needs can prove to be crucial basis for this communication. The paper by Timmerman and others provides a framework for the specification of information needs.
- *Creation of understanding of, and support for, approaches chosen.* The people involved in the process must have an open mind and show interest in each others' concerns and working methods. Only understanding can lead to support.
- *Orientation on the process rather than on the project.* There is a common tendency to focus on 'technical' details of a project, meanwhile avoiding more sensitive, political issues, which usually in the end are crucial to the success of a project. By focusing on the process, a more realistic view of the requirements for the success of the project can be obtained, thus avoiding unnecessary pit-falls.
- *Special attention for the level of aggregation.* For example:
  → aggregation across spatial and temporal scales. As e.g. the social and economic disciplines normally work on lager scales then the natural disciplines, integration of information of different disciplines can be a tough task.
  → type of models used. Only a truly independent institute can develop widely accepted high level models.
- *Setting of clear priorities.* Having a clear objective can be very helpful in choosing the right measures. For example, a flat-rate emission reduction approach can be much less cost-effective compared to an effects-based emission reduction approach
- *Uncertainty issues.* Uncertainty can be used to delay action, therefore it can be advantageous to direct the research agenda to the most uncertain parts of a complex problem.
- *Multiple information sources.* Information from different disciplines is needed for integrated assessments. There is however no necessity for each project to provide all the data needed for an integrated assessment. Suitable information can nowadays be obtained from various organisations through various tools like internet, models, and decision support systems.
- Realistic ambitions. A simple start can provide proof that the approach chosen really works.

The following sections examine these issues in more detail.

## THE MULTIDISCIPLINARY APPROACH

Focusing on the multidisciplinary approach within integrated water assessment, it appears that there is a need for translation across disciplines. The term 'compliance monitoring', for example, is a way of keeping up with the progress made in implementing policy actions in the socio-economic sciences. On the other hand, in the natural sciences 'compliance monitoring' is used for testing against standards. Specialists in different fields also have naive expectations of work from other disciplines. In water science, for example, environmental values and environmental damage functions are often incomplete or missing. Such different perceptions hamper communication between disciplines. Another issue that hinders communication between disciplines is the mismatch in spatial and temporal scales. Monitoring in the natural sciences is performed on a rather detailed scale in time and space (monthly in a river stretch), whereas the socio-economic sciences focus on larger scales (yearly in a province).

To overcome communication mismatches, closer, and regular, contact is needed. Working towards sustainable solutions calls for intensive co-operation and communication between policy-makers and scientists in a multi-disciplinary, and, where relevant, transboundary setting. Through the exchange of ideas, such co-operation enhances the mutual understanding, and, consequently the support of solutions. Sharing of a common problem in a 'joint learning curve' eventually leads to a better utilisation of knowledge and available information. One crucial condition to make such co-operation work is a strong notion of joining in the effort by involved stakeholders. Pollution problems often have multiple causes and cannot be connected to only one of the parties involved. Furthermore, , solving one pollution problem may cause another. The paper of Harremoës and Turner provides examples of this. When the aspect of blaming each other enters the discussion, the effort will go into denial and counter-blaming while any possibilities for solving the problem will be delayed or even blocked. A basis for communication may be found in the use of indicators, where, from a natural science point of view, the D-P-S-I-R framework may assist in bridging the gap between disciplines. However, the multidisciplinary approach will require us to change our present-day organisations.

## INDICATORS

Indicators may help in simplifying communication. Aggregation to the desired scale can in particular be an important issue that is supported by the use of indicators. Next to this, the use of indicators is frequently linked to the presentation of data and information. Figures provide good possibilities to present the aggregated data in a condensed format. The Cyprus example (Michaelidou and Maro) shows condensed information in nine quality/effects indices, which when grouped in one AMOEBE type figure, provide a powerful communication tool. The Dutch Vechte example (Verhallen and others) shows that it is possible to communicate uncertainties through indicators. The UK-example (Seager) shows that the indicator of 'percentage of rivers with good quality' provides useful information for policy-makers. However, the indicator is an aggregation of a multitude of data, which leads to the conclusion that the use indicators does not necessarily imply a reduction of the monitoring effort.

During the workshop it appeared that the D-P-S-I-R framework has wide support. There are, however, few, if any, examples of full implementation of this framework. Reasons for this may be that the information 'system' is not yet embedded in an integrated assessment framework or in a multidisciplinary approach. But the D-P-S-I-R framework is not the last step in the multidisciplinary approach. Communication should be tailor-made. To illustrate, for politicians there is a need for indicators that describe the progress in the policy process. Also, decision-makers require information on a high level of aggregation. This once again stresses that the dialogue between policy-makers and scientists is imperative. Consequently, also in the field of indicators there are no universal solutions, and there is still much work to be done.

## MONITORING PRACTICES

Contributions to Monitoring Tailor-Made III provide many examples of initiatives for introducing tailor-made practices. The issues dealt with in previous MTM workshops reappear; quality assurance for instance, is not limited to laboratory analysis, but is now extending to sampling procedures and biological measurements. Statistics, agreed methods (protocols), and knowledge of chemical, hydrological and biological processes are applied in the development of monitoring networks. Information and communication technology (ICT) plays a major role in data-management and the monitoring cycle is implemented. All this signifies that improvement in monitoring is a continuous process.

The need to establish a dialogue with policy-makers is generally acknowledged and linked to the importance of specification of information needs. In the process of specifying information needs, practices from the social sciences prove to be useful, such as the 'devil's advocate' technique. Many initiatives to improve or organise co-operation have been shown during MTM-III. Examples are the US National Water Quality Monitoring Council, ECE guidelines on transboundary waters, the Lake Peipsi example (which explicitly includes the important aspect of capacity building), and various examples on regional scales.

One important aspect of monitoring discussed was the need to reserve time / capacity in the monitoring network design for special surveys. There should be slack in the monitoring network to enable the performance of survey activities on subjects that are not yet known at the time planning is done. In this way, "surprise" issues can be quickly addressed with appropriate monitoring programs.

In the case of pollution incidents, emergency monitoring and rapid assessment of the hazard and likely exposures are needed to determine the immediate actions. This should then be followed by long-term monitoring and assessment of the progress of rehabilitation of the contaminated area. In preventing accidental pollution, an inventory and risk assessment of potentially hazardous sites should be made.

It may be concluded that progress in improving monitoring systems is being made, but there is no reason to be satisfied. The numerous capabilities offered by modern technology are rarely used and the major problems we are struggling with are not addressed from an information technology point-of-view.

## MONITORING AND COMMUNICATION

As people become more and more politically aware, they demand more information. This leads to a situation where information is provided outside the long-established sphere of legislation, governments and industries. Accidental situations are significant events in this respect. During pollution incidences, for instance, communication of information to the public plays a major role, especially in avoiding misunderstandings of the actual state of affairs. To be prepared for incidences, a plan should be ready for co-operation between the involved institutions, communication between the institutions and to the 'outside world', and monitoring. In developing such communication plans much can be learned from social scientists. For example, 'the public', as a uniform entity, does not exist. There are different groups of stakeholders, each having their own interests and concerns. In communicating, each group should be addressed in a different way. The media (newspapers, television) play a significant role in dissemination of the information to 'the public'. This role can be supportive yet also misleading. In any case, the role of the media is unpredictable.

Three interconnected levels of communication can be distinguished:
1. Provision of information as a means to increase awareness: this type of communication is currently used most frequently; the situation is described together with possible consequences.
2. Appeal to ethical standards to change behaviour: this type of communication appeals to the citizen's conscience. One example is a government message that drinking water is a scarce resource and the public should be careful not to waste water .
3. Involvement of 'public stakeholders' through a genuine dialogue, which will require institutional reforms. In many countries, public participation is used to inform the public, but also to improve plans (i.e. "true" inclusion).

The first two levels of communication are largely one-way options whereas the third level assumes a two-way dialogue. The challenge for the water science people will be to think beyond a technical approach and prepare for better communication.

## INFORMATION AND INTERNET

More and more, the internet is seen as the medium of choice to disseminate information. Reporting is done on the web in real time, open GIS is very popular to unlock information and, also, the internet is an important source of information, for instance for downloading remote sensing images. As more data are available through the internet it becomes more apparent that data cannot easily be compared. Consequently, the internet is considered to be an instrument to enforce comparability. The full potential of the internet however is not yet exploited. The internet is still seen as an easy to distribute, up-to-date 'modern brochure' with real time, changing data. The possibilities of the internet, for instance, as a medium to interact with stakeholders is not yet fully developed.

## RECOMMENDATIONS

Providing information for integrated water management requires major changes in the customary method of monitoring. It demands intensive co-operation between policy-makers and scientists. It also requires a multidisciplinary approach that utilises the expertise of various scientific disciplines. Such changes cannot be achieved without changing the present-day organisation and an development of a willingness to think beyond the narrow technical approach.

The D-P-S-I-R framework provides a setting in which a multidisciplinary approach can be stimulated. Driving forces and societal Responses require interpretation from the socio-economic disciplines, whereas Pressures, State and Impact can be approached from the natural disciplines. Indicators within this framework can be powerful communication tools for co-operation between policy-makers and scientists.

Communicating water science information to 'the public' demands insights from the social sciences. True communication with and involvement of the public can only be achieved by a genuine dialogue.

Rapid developments in technology provide numerous opportunities to improve monitoring and dissemination of information. Effort is needed to explore such opportunities and exploit the existing technological possibilities.

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