SESSION II a

ADEQUATE INFORMATION

Lessons learned from pilot projects under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes

Martin Adriaanse [1]
GPA Coordination Office, United Nations Environment Programme, P.O. Box 16227, 2500 BE, The Hague, the Netherlands
e-mail: m.adriaanse@unep.nl, web site: http://www.gpa.unep.org/

Introduction

This paper gives an impression of the lessons learned in 5 years of pilot projects on monitoring and assessment under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention). The pilot projects were carried out in central and eastern European river basins. For the most part, the project leaders of these countries gave their impression about the lessons learned. Some reflections of the programme leader are added to give some more background information and explanations.

The pilot project programme

Eight pilot projects on monitoring and assessment of transboundary rivers were initiated in 1997 as part of the work programme under the UNECE Water Convention. The pilot projects were intended to improve the monitoring and assessment of transboundary rivers and to implement the 1996 Guidelines on Water-quality Monitoring and Assessment. The objectives of the pilot projects were:

- To demonstrate implementation of the guidelines;
- To support countries with this implementation;
- To review the guidelines on the basis of the lessons learned from the pilot projects.

Figure 1. Pilot projects on monitoring and assessment under the UNECE Water Convention

[1] The author was a former staff member of the Institute for Inland Water Management and Waste Water Treatment (RIZA) and programme leader of the pilot projects on monitoring and assessment under the UNECE Water Convention.

The programme was prepared by a Core Group on Pilot Projects, in which country project leaders participated. The Inception phase of the project, including conclusion of Memorandums of Understanding by the riparian countries, proposals for funding and their acceptance for five pilot projects, and the preparation of the project organization took a considerable time.

First activities in these five projects (Mures/Maros, Morava, Bug, Ipel'/Ipoly and Latorica/Uzh) started in 1998. This paper mainly deals with the lessons learned from these pilot projects. The pilot projects on the rivers Tobol, Kura and Serverski Donets started late 2001, as part of the EU Tacis programme.

The projects were further divided into:

- A Preparatory phase, where the information needs were analysed and recommendations for improvement of the monitoring and assessment were made on the basis of an identification and review of water management issues in the basin;
- An Implementation phase, where the recommended monitoring and assessment programme is implemented.

The Core Group on Pilot Projects, together with the Netherlands as lead country, developed and discussed the project approach. Figure 2 shows the activities of the Preparatory phase. For each activity, Terms of Reference were developed and agreed, as a guidance for the implementation of the activities.

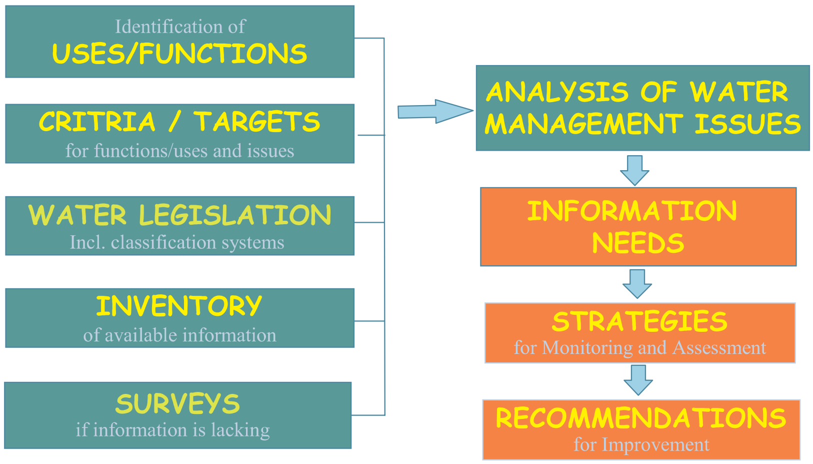


Figure 2. Activities in the Preparatory phase of the pilot projectsLessons learned

A discussion was held amongst country project leaders about their findings and feelings, and about the experience gained over several years of pilot projects. The outcome has been grouped afterwards in five categories: project achievements, project organization, mentality changes, personal skills and social aspects.

Project achievements

The pilot projects represent strong examples of implementation of the Water Convention. The projects provided in several countries a first hand opportunity for river basin approach in an international context. At the start of the projects, in 1998, this approach was unique in these countries and the pilot projects had the character of pioneer projects. Before, the focus of most international cooperation activities was on the border sections and not on the problems within the entire transboundary river basins.

In the countries concerned, the approaches to monitoring and assessment were improved, made more advanced and brought on a higher scientific level. The projects pushed ministries to start new initiatives and approaches to monitoring and assessment. With their focus on problem identification and the relevance of information, the projects are an advertisement of a logic and cost-effective approach to monitoring and assessment.

Project organization

The pilot project activities took much more time than expected. Due to this prolongation, in some countries it was problematic to make arrangements for extra project time and budget.

A first prerequisite for a pilot project is to create good and flexible project teams including one or two "core" people from each country and other relevant national experts. In practice, joint meetings of pilot project teams from riparian countries are difficult to arrange, because the costs of travel and lodging are an obstacle. It has proven to be very successful to create ample opportunities for work sessions of the project teams during the regular meetings under the entire pilot project programme.

The structure of project activities in the pilot projects has proven to be useful. For the successive pilot project activities, Terms of Reference (TOR) have been drafted, discussed and agreed by the Core Group. Some project leaders felt that the TORs were not clear enough. Others were of the opinion that it was good to start with TORs, but these should allow for some flexibility, so that they could be amended according to the characteristics of the river basin, which are sometimes very specific. At the same time, it was also stressed that limits should be set to the flexibility of the TORs.

In neighbouring countries, the responsibilities for taking decisions may lay on different (political) levels. This can be an impediment for communication and finding agreement. It can be difficult or even impossible to get people with comparable responsibilities together in one meeting. Furthermore, political and legislative changes in countries are interrupting the progress of the projects.

Cooperation is much easier between two countries than among three. It is quite an achievement to get to a constructive cooperative work relation. It takes time to build mutual understanding and trust, which are cornerstones for such cooperation. It is also important to keep in touch with the international river basin commissions for the respective river basins.

The EU Water Framework Directive [2] came in later. It would have been easier if the Directive were available in 1998 when the pilot projects started; it was felt that the situation will be easier for groundwater pilots that have started recently. However, the process of discovering what is relevant information for the river basin management on the basis of the problem identification would have been missed.

Personal skills

The projects strengthened the cooperation between countries. Useful experience has been obtained on how to increase collaboration between experts of different States and how to exchange experience on a river basin scale. It is felt that this experience can be used in other working groups in transboundary cooperation.

The projects also offered opportunities to learn how to prepare reports, how to communicate results and to use English as a common language for cooperation.

Mentality changes

Positive changes could be noticed in the traditional way of thinking, which can be an obstacle for communication: dare to raise and answer questions, dare to argue and counter. A breakthrough could be noticed in the preparedness for data exchange.

Social aspects

It is important to know people from neighbouring countries and their mentality. Making friends in other countries is an excellent basis for cooperation. In many cases, a joint project was only possible because a good and friendly group of experts was created.

Interpretation

- For the pilot projects in central European countries it was decided to have the projects lead by country project leaders, to have the reports written by authors from the countries and to have the projects mainly paid from the national budgets. The alternative is to have the projects done by consultants from western countries. Anyway these need counterparts from the host country, but all conceptual responsibilities for

[2] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, published in the Official Journal L 327 of 22/12/2000.

project activities, analysis of results and writing of the report are with the consultant. It is the basis on which consultants work in central European countries: the risk of being hampered in their contract obligations by a non-western approach is too big. Capacity building became therefore an important element for the pilot projects where countries themselves where responsible of the project activities and reports.

- Ministries are small and staff is over-occupied, but ministries own all responsibilities. Management decisions are taken at high political level. It is a tendency to appoint country project leaders from the ministries, but such people have no time to write reports and should be seconded by qualified experts who can do the analytical and editorial work.
- The recommended approach (the guidelines) for monitoring and assessment under the UNECE Water Convention is more than just "making a monitoring programme". This has not enough been foreseen by the countries. It is new for central and eastern European countries to have effective and relevant information for the managing of water resources realised in an efficient and tailor-made way. However, also western countries have a rather short tradition to get out of the "data-rich but information-poor" practices. In central European countries, the practice of following rigid rules and standards and to rely on monitoring obligations can directly be explained from the before-1990 period. After 1990, the mentality and way of thinking cannot directly be turned around. Moreover, the argumentation behind "much more time was needed" has not only to do with a wrong planning of activities, but also with a recommended approach which was not common, was not understood, and was against the usual way of thinking.
- Finally, the English language is a major problem. English should only be one of the languages in an international project between countries. To achieve enough ownership of the projects, relevant documents should be translated in country languages. As soon as it has been decided that countries themselves play an important role in the drafting and completion of reports and in the lead of project activities, the country language should be recognised as equally important as the English language.

Acknowledgement

The country project teams, the project leaders and authors of reports, are acknowledged for sharing their joined experience. This concerns Ferenc Laszlo (Hungary), Zsuzsa Steindl (Hungary), Alexander Samusenko (Belarus), Natalya Utochkina (Belarus), Vladimir Korneev (Belarus), Natalya Chismakova (Ukraine), Alexeï Yarosevitsj (Ukraine), Oxana Tarasova (Ukraine), Teresa Zan (Poland), Malgorzata Landsberg (Poland), Alexandra Vancova (Slovak Republic), Zdena Kelnarova (Slovak Republic), Ilja Bernardova (Czech Republic), Stanislav Juran (Czech Republic), Juliana Adamkova (Slovak Republic), Carmen Ognean (Romania), Ileana Sandu (Romania), Florin Moldovan (Romania), Daniela Durkovicova (Slovak Republic) and Peter Roncak (Slovak Republic). Also the project leaders of the three recently started pilot projects, Valery Kukosh (Russian Federation), Maisa Adigezalova (Azerbaijan) and Mariam Makarova (Georgia) should be mentioned for their valuable contribution to the meetings of the Core Group on Pilots Projects.

References

1. UNECE Task Force on Monitoring and Assessment (TFMA), 2000. Guidelines on Monitoring and Assessment of Transboundary Rivers. RIZA, Lelystad, the Netherlands.
2. UNECE TFMA, 1999. Pilot Project Programme on Monitoring and Assessment of Transboundary Rivers. Reference Report No.1. RIZA, Lelystad, the Netherlands.
3. UNECE TFMA, 1998. Pilot Project on Mures/Maros. Report No.1. Inception report. RIZA, Lelystad, the Netherlands.
4. UNECE Working Group on Monitoring and Assessment (WGMA), 2002. Pilot Project on Mures/Maros. Report No.2. Identification and Review of Water Management Issues.
5. UNECE TFMA, 1998. Pilot Project on Morava. Report No.1. Inception report. RIZA, Lelystad, the Netherlands.
6. UNECE WGMA, 2002. Pilot Project on Morava River. Report No.2. Identification and Review of Water Management Issues. RIZA, Lelystad, the Netherlands.
7. UNECE TFMA, 1998. Pilot Project on Bug River. Report No.1. Inception report. RIZA, Lelystad, the Netherlands.
8. UNECE WGMA, 2002. Pilot Project on Bug River. Report No.2. Identification and Review of Water Management Issues. RIZA, Lelystad, the Netherlands.

9. UNECE TFMA, 1998. Pilot Project on Ipel'/Ipoly. Report No.1. Inception report. RIZA, Lelystad, the Netherlands.
10. UNECE TFMA, 1998. Pilot Project on Latorica/Uzh. Report No.1. Inception report. RIZA, Lelystad, the Netherlands.
11. Adriaanse, M., Landsberg-Uczciwek, M., Roncak, P., 1997. Pilot projects for Monitoring and Assessment of Transboundary Rivers under the ECE Water Convention. Mrzezyno, Poland.

Bug surveys: an initiation of transboundary cooperation

Malgorzata Landsberg-Uczciwek
Voivodeship Inspectorate of Environmental Protection in Szczecin, Wały Chrobrego 4, 70-500 Szczecin, Poland
e-mail: gosialu@wios.szczecin.pl, web site: http://www.wios.szczecin.pl/
Teresa Zan
Regional Water Management Board in Warsaw, Inspectorate in Lublin, ul. Narutowicza 56, 20-016 Lublin, Poland
e-mail: insp.lublin@rzgw.waw.pl

Introduction

The Bug River basin is situated in the north-west part of Ukraine, south-western Belarus and in the central-eastern part of Poland, and is within the Baltic Sea catchment area (Map 1). The total area of the Bug basin is 39,400 km^2, which is 19.3% of the Vistula basin.

Map. 1. The Bug River in the Baltic Sea basin

The area of the Bug River basin is shared by three countries belonging to different political and economic systems. The fundamental difference in the way water is managed in the three countries is that in Ukraine and Belarus, management is placed within the administrative boundaries, whereas in Poland, basin management was introduced in 1992, and has been strongly supported by the new Water Law of 2002.

Poland is in the process of accession to the EU, with the expected date of accession 1 January 2004; Ukraine is currently adapting its legislation to the laws of the European Council, while Belarus uses a separate legislative system.

The area of the basin belongs to different administrative regions in each country; two in Ukraine - Volyn and L'viv Oblast; one in Belarus - Brest Oblast; three in Poland - Lublin, Podlaskie and Mazowieckie Voivodeships. Thus the implementation of water management and monitoring systems differ not only between, but also within the countries themselves.

The pilot project on monitoring and assessment under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) initiated international cooperation within the basin area. Practical cooperation between the institutions involved in monitoring activities of watercourses and water management in each country, started with the organization of a survey intended to fill gaps in the knowledge of threats to the Bug River ecosystem.

Transboundary cooperation in the basin

Before 1992

The cooperation between Poland and the Soviet Union concerning rivers crossing their mutual border has a long history, which unfortunately has not always led to shared objectives. In the agreement between Poland and the USSR on the use of water resources in frontier waters (1964), the countries established monitoring networks on the bordering part of the river Bug. The investigations on water quality were carried out separately by each country using its own methodology. There was no exchange of information on the sources of pollution.

The break-up of the Soviet Union contributed to significant changes in Europe. On the eastern border of Poland new neighbouring countries have appeared, resulting in the need for new cooperation agreements.

After 1992

The period after 1992 was a time of political transformation in Poland, Ukraine and Belarus, and of administrative reforms and changes in the field of water management.

Cooperation between Ukraine and Poland led to the following treaties being ratified:

- The treaty between the Republics of Poland and Ukraine on legal relations along Polish-Ukrainian State border and on international border cooperation (Kiev, 12 January 1993);
- The agreement between the Governments of the Republic of Poland and Ukraine on interregional cooperation (Kiev, 24 May 1993);
- The agreement between the Governments of the Republic of Poland and Ukraine on cooperation in the field of environmental protection (Warsaw, 24 January 1994);
- The agreement between the Governments of the Republic of Poland and Ukraine on cooperation in the field of water management on rivers crossing their mutual border (Kiev, 10 October 1996).

The last agreement provides the basis for cooperation on surface water and groundwater quality and quantity management, monitoring, flood control, as well as a basis for exchange of information.

On the basis of this agreement, the “Polish-Ukrainian Committee for Cooperation in the Field of Bordering Waters” has been formed. The following Polish-Ukrainian Working Groups have been established:

- A working group for planning;
- A working group for protection against pollution;
- A working group for flood protection, river regulation and land melioration;
- A working group for hydro-meteorology and hydro-geology;
- A working group for accidental pollution control.

Cooperation between Poland and Belarus is regulated by:

- The treaty between the Republics of Poland and Belarus on friendly regional cooperation (Warsaw, 23 June 1992);
- The agreement between the Governments of the Republics of Poland and Belarus on the main principles of cross-border cooperation (Warsaw, 24 April 1992);
- The agreement between the Ministry of Environmental Protection, Natural Resources and Forestry of Poland, and the State Committee of the Belarus Republic for Ecology, on cooperation in the field of environmental protection (20 May 1992);
- The agreement between the Lublin Voivodeship and Brest Oblast on transboundary cooperation (Brest, 31 March 2000).

The 1992 agreement for cooperation in the field of environmental protection, which is most relevant to water protection cooperation, has been implemented to only a limited extent.

The agreement on creating the transboundary union “Euroregion Bug”, formulated in Luck on 29 September 1995, is the only form of trilateral cooperation not directly connected with environmental protection.

Although the present trilateral and bilateral cooperation leaves much to be desired, the importance of bilateral international cooperation at the level of administrative regions should be emphasised. Many valuable initiatives are a direct result of such cooperation (e.g. Polesie and Roztocze International Biosphere Reserves).

Pilot project

The pilot project on the Bug River under the UNECE Water Convention started in January 1997. Ukraine is a Party to the Convention since 1999, Poland since 2000. The Memorandum of Understanding (MoU), among the Ministry for Environmental Protection and Nuclear Safety of Ukraine, the Ministry of Natural Resources and Environmental Protection of Belarus, and the Ministry for Environmental Protection, Natural Resources and Forestry of the Republic of Poland, on Collaboration in the Development and Implementation of the Joint Pilot Project on Monitoring and Assessment of Transboundary Rivers, was signed in 1997.

The initiation of pilot projects on monitoring and assessment under the Water Convention led to cooperation between countries in a river basin context. Institutional difficulties connected to the establishment of such projects are comparable with those of the establishment of similar joint bodies. The first part of the project had a more political and managerial, rather than technical, character. The project concentrated on water management policy, institutional organization in the bordering countries, water uses and functions, as well as providing all necessary information.

Pilot projects under the UNECE Water Convention are made up of two phases: the preparatory phase and the Implementation phase.

The first part of the preparatory phase - the inception - consisted of the following activities:

- Preparation of the project proposal and funding of the project;
- Establishment of the project organization;
- Preparation of the inception report, including a description of the river basin, current monitoring and assessment practices, responsible institutions, project organization; resulting in a project plan for the pilot project;
- Conclusion of the overall project plan for the pilot-project programme.

The results of the inception phase of the Bug pilot project were published in the Inception report in 1998.

The second part of the preparatory phase - monitoring and assessment needs analysis - consisted of the following activities:

- An inventory of available information concerning water-quality issues and current practices for monitoring and assessment, including results of previous investigations;
- An evaluation of legislation and regulations;
- Preliminary surveys to obtain an insight into the gaps of information;
- A specification of information needs, the development of strategies for the monitoring and assessment and evaluation of current practices;
- A set of recommendations for improvement and an estimate of the costs of improvement.

The realisation of this phase in Poland and Ukraine started in 1999. In Belarus, the project started in September 2000. Ukraine completed the project in 2001, Poland has already accomplished most of the tasks within the preparatory phase, whereas Belarus will finish by 2002.

Institutions involved in monitoring and assessment, and their experts from different countries, were engaged in these activities at this stage of the project.

Survey and common sampling

In addition to the emission inventories and water-quality monitoring data, supplementary surveys were performed in order to get additional data to identify problems and to specify what monitoring is needed in the Bug basin. The survey activities involved the preparation of a programme for a survey at hot spots and key locations in each part of the Bug River basin, and the analysis of water, waste water, and sediment quality. This programme was undertaken by the neighbouring countries using chemical, ecotoxicological and ecological methods, and the details of the programme were based on the character of the pollution within each part of the basin.

The surface water and sediment survey sites were positioned along the Bug River upstream and downstream of the border, along the border river course, and at the confluences of the most polluted tributaries.

The location of sampling points is given in Map 2.

Map 2. Location of sampling points in the Bug River basin

With the above-mentioned purposes of the surveys, the following targets for common sampling were further developed:

- Understanding the physical condition of the river system in order to redesign the monitoring network; many local experts did not have (proper) access to the border stretch of the Bug;
- Comparison the location of the current sampling points and their assessment for the purpose of common sampling in the future;
- Joint sampling, analyses, and evaluation of findings with neighbouring countries;
- Involvement of different laboratories (including laboratories which are performing routine monitoring in particular countries) in a combined joint initiative.

Common sampling took place in July 2000 and in April and October 2001. This was the first time that the whole Bug River basin was included. In the case of Ukraine and Belarus, sampling was organized as part of projects under the EU-TACIS programme. In the Polish part, the routine sampling procedure was adapted to the needs of the pilot project.

In the year 2000, 19 laboratories were involved in the common sampling (14 from Ukraine, 3 from Poland, 1 from Slovakia and 1 from Germany). In 2001 there were 18 laboratories (2 from Ukraine, 6 from Belarus, 9 from Poland and 1 from Slovakia).

The range of measured parameters included basic physicochemical parameters, eutrophic, inorganic, hazardous substances and biological indicators.

New information after the survey

Common sampling

The common sampling delivered a set of very important conclusions. There are several issues relating to analytical methodologies, data handling and quality management that are not presently harmonized either nationally or internationally.

Significant differences were recorded in many of the results from common sampling points, even though each national laboratory used accredited methods. Even for the traditional parameters, large differences exist. This indicates that either the sampling methodology was not uniform or that the methods of analysis produce results that are not comparable. There were also differences noted in the reporting of results, which represented an obstacle to the interpretation of the data.

Regarding heavy metal analyses, the situation is generally unsatisfactory. It can be concluded that obsolete equipment and methods were used. Detection limits were often too high for water-quality assessment.

The need for good interlaboratory comparability has become both a national and international issue. Therefore the situation requires action within and between the countries.

Organic micropollutants

Generally, the analyses for organic micropollutants in both water and sediment samples indicated a rather low level of contamination. For quite a number of parameters, the survey findings show that organic micropollutants are actually absent (taking into account the detection limits) along ther stretches investigated.

Most of the findings for organic micropollutants are first-time-results. Therefore, it is strongly recommended that investigations and laboratory analyses for confirmation of the results continue.

One group of substances which can be considered for inclusion in the future monitoring system are the polycyclic aromatic hydrocarbons (PAHs) which were found in sediments.

For some of the organic micropollutants identified sporadically during the surveys, further investigations are needed to verify their presence or absence.

Heavy metals

Heavy metals were discovered in some sampling places (in sediments) but, as mentioned above, the methodology and comparability of these analyses need to be improved and adjusted to one system of environmental criteria. The criteria for heavy metals for each country differ significantly, and concentrations measured in the water or sediments in one country and assessed as “very high” are regarded as being “low” in other countries.

Toxicity tests

Chronic toxicity, based on various biological tests of water and sediments, was evident in a number of samples in the Ukrainian part: at the sites on the Bug tributary Poltva, above and below the L’viv waste-water treatment plant, and downstream from the L’viv city landfill on the Bug main course at few stations, and on the tributaries Solokiia and Luha. Chronic toxicity was observed in the samples taken from stations in Tomashovka, Kolodno (Bug River) and Brest (the Mukhavets). The results of ecotoxicity investigations of water and sediment in the Polish part of the Bug River basin indicate that chemical contamination occurred with moderate to high toxicity of water and sediments in few sampling locations of the main course of the Bug River (Terespol, Dorohusk, Popowo and Brest), and in few tributaries (Solokiia, Huczwa, Uherka and Krzna).

The toxicity discovered was not always consistent with chemicals in the water and sediments. Such cases need to be investigated further.

The results of ecotoxicological tests have shown a high correlation between the assessment of waste-water quality and the assessment of its toxicity (in the Polish part of the basin). In most cases, well-treated waste water was neither toxic nor moderately toxic. Poorly treated waste water was toxic, except in one case where well-treated waste water was also toxic. This discrepancy needs to be investigated.

Standards for applied ecotoxicological assessment were different in each part of the basin. Standardised tests should be worked out and implemented in the whole basin. Ecotoxicological tests, which are sensitive, simple and fast, can be used as part of an integral assessment programme in the Bug River basin, and the frequency of such investigations should be agreed. Based on the results of comparative analysis, a set of most suitable tests can be chosen as a tool to determine the level of chemical contamination of water, sediment and waste water in the Bug River environment.

Hydrobiology

The hydrobiological quality of the water in the upper Ukrainian part of the Bug basin varies from “good” to “moderately polluted”. Unfavourable values of some hydrobiological indices (poor ecological status) were found only at three stations (the Bug River at Terespol, and the Solokiia and Krzna Rivers).

The whole study showed that the river Bug is potentially capable of recovery to “good” ecological status.

Sampling points for transboundary monitoring

The activities performed in the years 2000/2001 along the cross-border stretch of the Bug River allowed the location of sampling points to be verified (Map 2).

Three stations should be sufficient for the Bug River cross-border monitoring along the Belarusian-Polish stretch, and three stations for the Polish - Ukrainian stretch.

Parameters to be included in transboundary monitoring

The range of parameters which should be monitored within the transboundary monitoring depend on monitoring goals, accepted standards of water quality, priorities within the river basin and in transboundary countries. The results of the investigations allow the following suggestions as to the range of parameters and periodicity within the transboundary monitoring programme of the Bug River:

- Basic parameters, 12 times a year - water temperature, pH, conductivity, suspended matter, hardness;
- Oxygen regime, 12 times a year - BOD_5, COD, dissolved oxygen;

- Nitrogen and phosphorus compounds - nitrites, nitrates, ammonia, total nitrogen, dissolved phosphates, total phosphorus;
- Heavy metals in water and sediments to be decided after laboratory analysis issues are solved, and sufficient data are gathered;
- Organic micropollutants in sediments, once a year - PAHs;
- Hydrobiological parameters, 4 times a year - zooplankton, phytoplankton, chlorophyll a, macrozoobenthos, phytoperiphyton;
- Parameters to be analysed not more than once a year - polar pesticides in water (target analysis), screening in water with liquid chromatography / mass spectrometry (LC/MS) and screening in water and sediments with gas chromatography / mass spectrometry (GC/MS).

The parameters which do not need to be included in the routine transboundary monitoring programme are organochlorinated pesticides, polychlorinated biphenyls (PCBs) and chlorinated phenols.

Hydrological measurements

The boundary Bug stretch is presently observed on the Polish side at five water gauges: Strzyzow, Dorohusk, Wlodawa, Terespol and Krzyczew. Hydrological observations at these sites are also used by Poland for water-quality assessment. Neither Ukraine nor Belarus make such observations at the boundary Bug stretch. Due to these reasons, it is suggested that the Polish data should be used, or that common profiles for hydrological measurements at the boundary stretch of the Bug be established, and common measurements of water discharge be harmonised.

Experiences on working together

How to organize cooperation practically

One of the goals of the pilot project was the initiation and strengthening of trilateral cooperation in the Bug basin between Poland, Ukraine and Belarus. This goal includes not only technical cooperation, but also to improve direct relations between countries. Common samplings were one practical step in this direction. To undertake common sampling, organizational effort was necessary, which taught how important it is to respect the differences in legislative systems and organization of decision-making. Contact with regulations during the activities on the border area was the first experience of that type for experts from the western countries. At the same time, it was a good opportunity to discover the realities that limit cooperation between Poland, Belarus and Ukraine.

Practical lessons learned

The first series of common sampling was the most difficult, as the decision to conduct them was taken the day before the planned date. Because of the difficult access to riverbanks, it took a lot of time to identify the location of sampling points. Problems with telephone communication also occurred. During the second series, the engines of both boats broke down, an accident was narrowly avoided, and the Polish crew exceeded the time limit of permitted stay on the Belarusian bank, which caused additional trouble. When organizing the third series, all the transgressions and nuisances that had appeared during the first and the second series were eliminated. Thanks to this, these samplings were continued efficiently and without any delay. The third series of samplings were treated as a routine activity by the participants of expedition and the border guard.

In planning future activities on the basis of this experience, delays in decision-making should be considered and emergency procedures in the event of accidents formulated. Experience gathered during the realisation of the pilot project should be used in further cooperation on transboundary water between Poland, Belarus and Ukraine.

Financial aspect

It is crucial that the Implementation phase of the pilot project starts immediately after the completion of the Preparatory phase. This will ensure that recent experiences are used in routine monitoring. However the full implementation of proposed changes can be difficult because of financial constrains. Therefore this implementation should be step by step, with constant progress. The planned continuity of activities appropriate to the financial condition of Poland, Belarus and Ukraine provides the chance to strengthen the transboundary cooperation in the Bug basin, and to build up a new model of cooperation on the basis of mutual trust and readiness for improvement.

Exchange of data

Results of laboratory analysis performed during the common samplings are collected in a database, which is the first one to include data from all the laboratories taking part in the monitoring of the Bug River. This is also the first data exchange between Poland, Ukraine and Belarus conceived on such a large scale, also including data relevant for water management analysis. This data was used in Report No. 2. Thus the first step in data exchange and the common use of data has already been achieved.

Involving experts and knowing each other

Common samplings also provided a lesson in international cooperation for experts from Poland, Belarus and Ukraine, as well as experts from western European countries. Growing mutual trust and interest of experts from different countries were noticeable when working together.

A revision of the common sampling took place during a workshop in December 2001 in Poland. It was not only an opportunity for summarising and assessing the results, but also a possibility to meet people from three countries sharing the same task. For many people from Belarus and Ukraine, it was their first visit to Poland. The workshop allow to present the ideas of the project to a wide audience and to emphasize the importance of the surveys and common sampling campaigns.

The workshop also provided an opportunity for participants of common sampling campaigns to get to know each other through conversations and exchange of experiences. It was an opportunity for "being together", and finding similarities and differences in mentalities. In the light of significant political, economic and social differences, all that is necessary to build up international cooperation in frankness, trust and consistency in achieving the common aim, which is effective water management of the Bug basin.

Summary

The realisation of the pilot project for the Bug River basin opens a new chapter in the transboundary cooperation between Poland, Ukraine and Belarus. This cooperation covers the whole river basin and its basic assumption is the close relationship between monitoring and assessment and water management. This requires the integration of activities between the institutions involved in monitoring and management in Belarus, Ukraine and Poland. Such integration and harmonization of activities is also necessary within neighbouring countries.

Common samplings have marked the beginning of practical cooperation in the basin on an international and regional level.

All the laboratories conducting routine monitoring in the whole Bug basin took part in common samplings. The sampling showed that the common assessment of water quality in the Bug basin can only be done when problems which revealed differences in the results of analysis are solved, and criteria for water quality agreed.

References

(all references are available on the web site of the International Water Assessment Centre - IWAC - at http://www.iwac-riza.org)

1. Task Force on Monitoring and Assessment under the UNECE Water Convention, Pilot Project Programme Transboundary Rivers, 1998. Bug Report No. 1, Inception Report, Lelystad, Netherlands.
2. Task Force on Monitoring and Assessment under the UNECE Water Convention, Pilot Project Programme Transboundary Rivers, 2002. Bug Report No. 2, Identification and Review of Water Management Issues, Lelystad, Netherlands.
3. UNECE, 2000. Guidelines on monitoring and assessment of transboundary rivers. UNECE Task Force on Monitoring and Assessment, Lelystad, Netherlands.

Risk assessment as a tool for policy makers

Peter Rončák, Juliana Adamková and Miroslava Metelková
Slovak Hydrometeorological Institute (SHMU), Jeséniova 17, 833 15 Bratislava, The Slovak Republic
e-mails: peter.roncak@shmu.sk, juliana.adamkova@shmu.sk, miroslava.metelkova@shmu.sk, web site: http://www.shmu.sk/

Introduction

There has been a dramatic increase in use of chemicals in recent years, many of them are new compounds and mixtures whose toxicological and ecotoxicological properties have not previously been studied and which might prove to be harmful to humans and other living organisms. Over the last decades, several substances previously thought to be inert or harmless in living organisms have been found to be carcinogenic or toxic to reproduction. A wide and increasing range of compounds have shown in animal studies to be mutagenic.

Consequently, despite the limited knowledge on hazards to living organisms associated with many chemical substances, most governments in the world have developed legislation aimed at protecting both human beings and ecosystems.

Since early 1990s, a number of international policy developments have focused on chemicals management and environment protection (1992 Rio Conference, UNECE Conventions, EU Directives, etc.). Additionally, several national authorities have developed risk assessment methods for new and existing chemical substances (e.g. Germany, the Netherlands, United Kingdom, Switzerland, United States of America). This approach might be an effective tool for other countries to address local needs of environmental and development policies.

The main objective of this paper is to give some answers to questions which might be raised by decision makers in the water management sector in order to achieve environmental protection and sustainable development. The results and findings presented in this paper were obtained mainly from the Phare project and the pilot projects [1] under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, performed in the Slovak Republic.

Decision makers and risk assessment

Each country or region can be at a different stage of development and use of risk assessment in the decision-making process. There are several definitions of risk assessment. One of them is given by UNEP (1996) as follows: “Risk assessment is a scientific attempt to identify and estimate the true risks and is the resultant of the considerations of its components: hazard, exposure - effect relationship and risk estimation. The phases of exposure assessment can be called screening, confirmation and investigative and are related to the level of detail of the data used.”

The first step of risk assessment is the evaluation of exposure of human beings and water organisms to a chemical substance. It requires a great deal of professional judgement. Exposures may be estimated by using monitoring data alone, or using a combination of monitoring data and environmental models.

The following are some general objectives that a decision maker might identify for the water management system:

- Identification of priority substances for the area concerned;
- Reduction of use of particularly hazardous chemicals;
- Reduction of exposure to toxic substances through the environment;
- Reduction of exposure and minimization of risks arising from inadequate disposal of chemicals;
- Accident prevention and effective response;
- Complete information on the current and potential impacts of chemicals on the environment and health.

[1] For more details on the pilot projects, refer to “Lessons learned from pilot projects under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes” by Martin Adriaanse, in this publication.

Case studies

As an example, the results of two case studies carried out in the Slovak Republic are given below to illustrate the use of risk assessment in water management.

Priority setting of chemical substances related to sediment

The following questions should be answered to identify priority substances:

- How does a chemical behave in water and sediments?
- How long might the chemicals remain in the environmental medium?
- Which are the main chemicals jeopardizing water bodies?

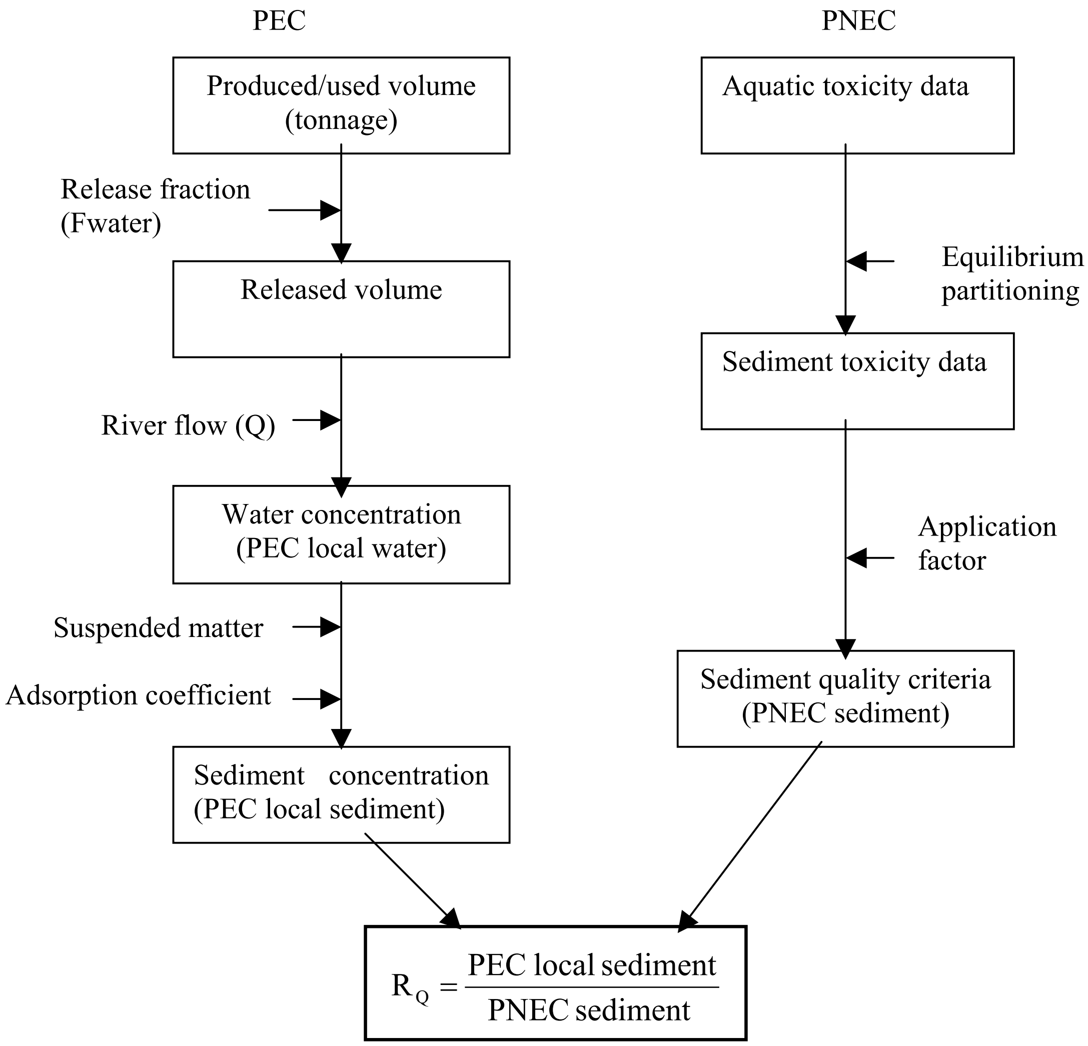
The approach was built upon the principles of the EU Technical Guidance Document on risk assessment of new and existing substances (EC, 1996) and used in PHARE project (ECORISK, 1998). Initially, a "Gross list" of pollutants was prepared including:

- Substances used, imported or produced in high volumes - more than 1,000 tons per year in the country, for pesticides more than 10 tons per year;
- Substances regulated by national legislation in waters, sediments and soils;
- Contaminants identified by governmental or international programmes or research surveys in sediments or surface waters;
- Hazardous substances/materials and wastes;
- Poisonous substances.

The substances in the "Gross list" (850 chemicals) were further prioritised according to their potential risk to organisms in sediments. Selection criteria were developed considering sorption, degradability and toxicity. Separate criteria were developed for organics and inorganics, but equal stringency was ensured for the two types of chemicals. The main purpose of this initial prioritisation was to limit the number of chemical substances to a manageable number of the most hazardous ones, for further evaluation and priority setting (124 chemical substances were selected).

The substances prioritised during the initial hazard assessment were further processed in a generic risk assessment. The generic risk assessment applies the overall methodology for environmental risk assessment of chemical substances, without focusing directly on specific sites. The purpose of the generic risk assessment is merely to identify substances which, on the basis of conservative estimates, may represent a potential risk for the sediment compartment. The approach is based on the comparison between the estimated Predicted Environmental Concentrations (PEC) and the Predicted No-Effect Concentrations (PNEC), thus establishing the so-called Risk Quotient (R_Q).

The scheme of the used generic risk assessment is as follows (ECORISK, 1998):



The $R_Q > 1$ means that chemical substance has potential risk for organisms in sediments. Due to uncertainties in the process of data collection also the substances with R_Q in the range of 0.1 to 1 were taken into account in the evaluation of risks for aquatic environment. The list of priority substances with R_Q values is contained in Annex I.

Potential accident risk spots

The following questions should be answered to identify potential accident risk spots:

- Which are the potential accident hot spots?
- Which are the chemicals of main concern for accidental pollution?

Recently, several accidents happened in the Danube River basin. These accidents had serious impacts on the river environment (killing most of the living organisms) and on the income from the fishing and tourism sectors. As a response, the Inventory of Potential Accident Risk Spots was made also in the Slovak Republic.

The approach developed by the International Commission for Protection of the River Elbe was found to be the most suitable tool for the analysis of industrial sites with high accidental pollution risk. This approach is based on a combination of water-endangering potential, expressed in terms of Water Hazard Classes (WHC), with the quantity of hazardous substances. The principle of WHC contains the criteria used in the EU

Seveso II Directive [2] and in the UNECE Convention on the Transboundary Effects of Industrial Accidents. Therefore, it was ensured that all industrial installations subject to these regulations would be included in this approach. At the end, a potential risk of an installation was assessed by using the so-called Water Pollution Index (WPI), which is a combination of the WHC and the relevant quantities of hazardous substances handled and stored in an installation.

In the Slovak Republic territory, 136 potential accident risk spots were identified. 57 of them were selected to be on the priority list with a WPI higher than 5 (ICPDR, 2000). However, it has to be said that such approach was able to give only an indication of the potential hazards. The actual risks arising from the hazardous sites depend on the safety measures that have been applied in each installation.

Conclusions

On the basis of the results from the case studies where risk assessment was used, the following can be concluded:

- Risk assessment can be a useful tool to assist in the decision-making process in the water sector:
  - To set up the list of priority substances;
  - To identify the potential accident risk spots in the river basin;
  - To set up the priority for safety measures in the potential accident risk spots in order to avoid accidents by hazardous substances in the watercourses;
- Risk assessment can play an active role in water-quality monitoring programme development via selections of media and chemical substances to be analysed.

References

1. EC, 1996. Technical guidance document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances, European Commission.
2. ECORISK, 1998. Ecological Risk Assessment of Pollution by Heavy Metals and Organic Micropollutants. Second phase report, PHARE project, PCU Vienna, Austria
3. International Commission for the Protection of the Danube River, 2000. Inventory of Potential Accident Risk Spots. Final report, ICPDR, Vienna, Austria

[2] Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, published in the Official Journal L 10 of 14/01/1997.

Annex I

List of Priority Substances with $R_Q \geq 1$

CAS	Chemical name	R_Q
72-43-5	Methoxychlor	343-724
9016-45-9	NPEO	219
61789-80-8	DHTDMAC	54.5
117-81-7	Di(2-Ethylhexyl)phthalate	33
84-74-2	Dibutyl phthalate	25
52315-07-8	Cypermethrin	25
60168-88-9	Fenarimol	20-150
101-72-4	N-Isopropyl-N´-phenyl-p-phenylenediamine	8.8
100-41-4	Ethylbenzene	4.9
51218-45-2	Metolachlor	4.8
95-33-0	N-Cyclohexyl-2-benzothiazolesulfen	5
115-29-7	Endosulfan	4.0-4.5
35367-38-5	Diflubenzuron	3.3
1582-09-8	Trifluralin	2.9-6.0
68085-85-8	Cyhalothrin	2.3
135-88-6	N-Phenyl-2-naphthylamine	1.7
40487-42-1	Pendimethalin	1.6-3.2
51630-58-1	Fenvalerate	1.0
42576-02-3	Bifenox	0.5-30
2312-35-8	Propargite	0.8-3.0
608-73-1	HCH isomers	0.5-1.5
42874-03-3	Oxyfluorfen	0.1-1.4
8008-20-6	Petroleum (Kerosene)	0.016-16
58-89-9	Lindane (Gamma-HCH)	≤3
72-20-8	Endrin	≤1.2

List of Priority Substances with R_Q between 0.1 and 1

CAS	Chemical Name	R_Q
7440-50-8	Copper	0.9
7439-97-6	Mercury	0.8
7440-02-0	Nickel	0.65
1861-40-1	Benfluralin	0.64
206-44-0	Fluoranthene	0.36
122-39-4	Diphenylamine	0.25
7440-66-6	Zinc	0.16
18181-80-1	Bromopropylate	0.1-0.3
115-32-2	Dicofol	0.1-0.2
15972-60-8	Alachlor	0.1
103-23-1	Bis(2- Ethylhexyl)adipate	0.1
1336-36-3	PCB	≤0.75

Projects on transboundary rivers - Criteria for water-quality assessment between countries

Ferenc László
Water Resources Research Centre (VITUKI), Kvassay út 1, 1095 Budapest, Hungary
e-mail: laszloferenc@vituki.hu, web site: http://www.vituki.hu/

Introduction

The need for water-quality assessment systems applicable between countries sharing transboundary rivers became urgent when the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes entered into force. The lack of joint, harmonized assessment/classification system was identified as a problem in carrying out the pilot projects to test the Guidelines on Monitoring and Assessment of Transboundary Rivers (M. Adriaanse, 2002).

Water-quality assessment systems were developed traditionally at national level. Differences are significant between national systems due to different approaches in water-quality management and environmental protection strategies. This paper illustrates the differences by comparison of the various assessment systems in the Danube countries, as four river basins of the above mentioned pilot projects (Morava basin in the Czech Republic, Slovakia and Austria; Latorytsya/Latorica and Uzh/Uh basins in Ukraine and Slovakia; Ipel/Ipoly basin in Slovakia and Hungary; Mures/Maros basin in Romania and Hungary) belong to the Danube River basin.

The compilation is based on the report of the Phare project "Water Quality Enhancement in the Danube River Basin, Action 2A: classification/characterisation of water quality" (IWACO, 1999) and on the report on "Assessment practices and environmental status of 10 transboundary rivers in Europe" (IWAC, 2001).

National water-quality assessment systems of the Danube countries

The main features of the different water-quality assessment methodologies applied in the Danube countries are as follows:

- Austrian guidelines focus on the ecological function of the surface water. Quality evaluation is based mainly on benthos analysis.
  Austria has a long experience in biological assessment of water quality. Macroinvertabrates, phyto-benthos and ciliates are sampled in rivers and the Saprobic Index is calculated.
  There is no specific assessment scheme for sediment quality. To get an orientation heavy metals are usually compared to the values of the "Geoakkumulationsindex", where background levels are taken into account, and to the Austrian standards of the ÖNORM L 1075, in which limit values are set for agricultural soil;
- Bulgaria distinguishes three types of water uses with corresponding water-quality targets for drinking and bathing water, water for agricultural use (irrigation, fishery) and water for industrial needs.
  Biological assessment covers the bacteriological and trophic status of water. Saprobity and macrozoobenthos species diversity is also determined at selected sites;
- The Czech Republic considers ecological quality of surface water. Classification of water quality is based on the degree of pollution, ranging in five classes. Each determinand is classified separately.
  The country has a long tradition in using the saprobity system for routine monitoring of rivers. Sediment quality assessment is based on criteria originally developed for soil. The sediment limit values for pollutants are based on toxicological characteristics which may cause important risks to human health and environmental hazard;
- Croatia focuses on the requirements for the various water uses. The water-quality classes refer to the water-quality criteria of the water uses;
- The German assessment system distinguishes three types of water uses as a basis for water-quality targets. The three water uses are: aquatic habitats, commercial and recreational fishing, and drinking water supply. For these water uses, quality criteria are set, not only in the water compartment but also in suspended solids and sediment. The integrated water-quality assessment system selects the strictest parameter values from the quality criteria of the water uses.

For sediment quality assessment Germany uses a sediment quality index. The index is based on eight metal concentrations. Each metal has a certain weight in the index;

- Hungary has defined five groups of determinands for water-quality assessment of surface waters: oxygen balance; nutrients and eutrophication determinands; microbiological determinands; micropollutants and toxicity; and macroions. The assessment is based on general consideration of anthropogenic impacts. The chemical components dominate among the determinands, the biological parameters are underrepresented.
  The bacteriological status (hygiene), trophic status and saprobity are monitored for biological assessment. Routine monitoring of sediment quality has not been introduced yet into the national monitoring system. Sediment survey results are evaluated according to the Canadian classification system (CCME, 1999). In case of agricultural disposal of dredged sediment, the soil quality criteria are used for sediment quality assessment;
- The Republic of Moldova uses an index of water pollution. The index is calculated from the measured concentrations of the determinands and the maximum admissible concentrations;
- The Romanian assessment system focuses on requirements for water uses. Use related criteria are set for drinking water supply and irrigation;
- In Slovakia the classification of water quality is based on six groups of determinands. For each group five limit values are set. The resulting five categories are used as guidelines for water uses.
  Sediment quality assessment is based on standardized methods;
- Slovenia considers the requirements for water uses: water of class I quality is suitable for drinking water (only to be disinfected), to support salmonide fish life, for food industry and for recreation; class II is suitable to support cyprinide fish life and for drinking water after treatment and disinfection, and for food industry; class III for irrigation and other industry; water of class IV quality is not suitable for any purpose;
- Slovenian water authorities use the Saprobic Index method for biomonitoring. The index and classification is based on the examination of periphyton and macroinvertebrates at the sampling sites.

Efforts of the Danube countries for joint water-quality assessment system

The Danube countries realised the necessity of a unified and coherent water-quality assessment system. The first step in this direction is represented by the launching of the Transnational Monitoring Network (TNMN) which is a harmonized system to regularly measure selected parameters in water and in sediment in the Danube River and in its tributaries, in 57 sections belonging to 11 different countries. The next step could be the introduction of common water-quality target values and classification system. A proposal has been developed for a classification system including identified background values, target values and limit values of quality classes for selected water-quality parameters. The Monitoring, Laboratory and Information Management Expert Group of the International Commission for the Protection of the Danube River will discuss the draft in 2003.

Another approach of water-quality assessment is part of the EU Water Framework Directive [1] (WFD). The Directive aims at improving the aquatic environment, with a primary concern on the quality of waters. Environmental objectives should be set to ensure that good status of surface waters and groundwaters is achieved. Surface water status is the general expression of the status of a body of surface water, determined by its ecological and chemical status.

Water quality should be assessed on the basis of information on elements related to the ecological and chemical status: composition and abundance of aquatic flora; composition and abundance of benthic invertebrate fauna; composition, abundance and age of structure of fish fauna; hydromorphological elements supporting the biological elements and physico-chemical quality elements (thermal conditions, oxygenation conditions, salinity, acid neutralising capacity, nutrients concentrations and specific pollutants, including priority substances).

The stepwise implementation of the WFD approach of water-quality assessment involves initial characterization of surface water bodies, identification of typology of waters, definition of type specific reference conditions, definition of quality standards, design of surveillance monitoring, operational

[1] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, published in the Official Journal L 327 of 22/12/2000.

monitoring and investigative monitoring. The implementation of the complete procedure will take several years for the Danube countries.

The short-term development of water-quality assessment of transboundary rivers should focus on:

- Broadening of hydrobiological parameters and inclusion of priority pollutants;
- Strengthening the role of surveys beside of monitoring;
- Continuation of compliance checking with water-quality criteria for different water uses.

References

1. UNECE, 2000. Guidelines on monitoring and assessment of transboundary rivers. UNECE Task Force on Monitoring and Assessment under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Available at the website of the International Water Assessment Centre (IWAC) at http://www.iwac-riza.org.
2. Adriaanse, M., 2002. UNECE Pilot projects on Transboundary Rivers. Lessons learned. In Proceedings of the Second International Conference on Sustainable Management of Transboundary Waters in Europe. Poland, Miedzyzdroje 21-24 April 2002.
3. IWACO, 1999. Water Quality Enhancement in the Danube River Basin, Action 2A: classification/characterization of water quality. Final report.
4. International Water Assessment Centre, 2001. Assessment practices and environmental status of 10 transboundary rivers in Europe.
5. Canadian Council of Ministers of the Environment (CCME), 1999. Canadian Environmental Quality Guidelines.

On the collection and use of environmental information in transboundary water management: the case of Lake Constance

Susanna Nilsson
KTH Royal Institute of Technology, Department of Land and Water Resources Engineering, Brinellv. 28, SE-100 44 Stockholm, Sweden
e-mail: susanna@kth.se, web site: http://www.lwr.kth.se
Sindre Langaas
UNEP/GRID-Arendal, Longum Park, Service Box 706, N-4808 Arendal, Norway
e-mail: langaas@grida.no, web site: http://www.grida.no

Introduction

During the last decades, there has been a call for more integrated management of rivers and lakes, interrelating different social, economic, and environmental aspects of water issues (UNECE, 1996, Savenije and van der Zaag, 2000). Furthermore, the river basin has emerged as the most appropriate spatial unit for water management, as opposed to more conventional administrative or political units (as for instance in the EU Water Framework Directive [1]). Integrated river basin management requires adequate information (Dinar, 1998). This is valid also for transboundary basins. Important tasks for international river basin organizations include monitoring of water quantity and quality, standardisation of data collection and sharing of relevant data (Savenije and van der Zaag, 2000). A review recently conducted by the UNECE also shows that the major areas of activity within formal transboundary water regimes concern monitoring, assessments and other information related work (Enderlein, 2001). Thus, research that increases the knowledge about the collection, storage, analysis, and use of environmental information in transboundary management of waters is needed.

This study has been carried out within the framework of the MANTRA-East project (Integrated Strategies for the MANagement of TRAnsboundary Waters on the EASTern European fringe - The pilot study of Lake Peipsi and its drainage basin). MANTRA-East is a EU-funded research project initiated to develop methods and strategies for integrated management of transboundary waters, in particular with respect to the requirements of the EU Water Framework Directive. One module in the project focuses upon aspects related to the role of environmental information in transboundary water management. In this context, studies about the collection, storage, analysis and use of environmental information in some selected transboundary waters in Europe are performed.

The objectives of this paper are to:

- Suggest a framework for environmental data and information handling for integrated (transboundary) river basin management; and
- Present the findings of its application to the Lake Constance region, one of the case areas within the Mantra-East project.

Frameworks for integrated river basin management

Timmerman et al. (2000) suggested the use of an Information Cycle model to facilitate water policy- and decision-making (Figure 1). The Information Cycle model was originally developed for water quality monitoring system design by the UNECE task force on monitoring and assessment, in 1996 (UNECE, 1996). It describes the essential steps in the continuously on-going process of information production and use. One main objective of the Information Cycle model is to facilitate the dialogue between producers and users of information. The first step in the cycle is to identify the information needs. Ideally, the information needs are identified by information users, such as policy and decision makers, in cooperation with information producers, such as experts and scientists. On the basis of experience, Timmerman et al. (2000) claim that defining the information needs is often the most critical, but yet, most important step in the cycle. The following step is to decide upon the best way to collect the required information, i.e. draw up an information strategy. The strategy is a mixture of the information needed and the best practical way in

[1] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, published in the Official Journal L 327 of 22/12/2000.

collecting the desired information. When the information strategy is decided, the actual data collection can begin. Data can be obtained from several sources such as monitoring, models or databases. The collected data are analysed and the resulting information should be presented and transferred to the users, i.e. policy and decision makers, in a proactive manner.

Figure 1. The information cycle (Timmerman et al., 2000)

The Driving forces - Pressures - State - Impacts - Responses (DPSIR) framework (Figure 2) builds upon an existing OECD state of environment reporting model and offers a basis for analysing the interrelated factors that influence the environment (EEA, 2002). In other words, DPSIR can be seen as a general framework for organizing information about the environment. The framework assumes that there are interacting components between social, economic and environmental systems, such as:

- Driving forces of environmental change (e.g. industrial production);
- Pressures on the environment (e.g. discharges of waste water);
- State of the environment (e.g. water quality in rivers and lakes);
- Impacts on population, economy, ecosystems (e.g. water unsuitable for drinking);
- Responses of the society (e.g. river basin protection) (Cunningham, 2000).

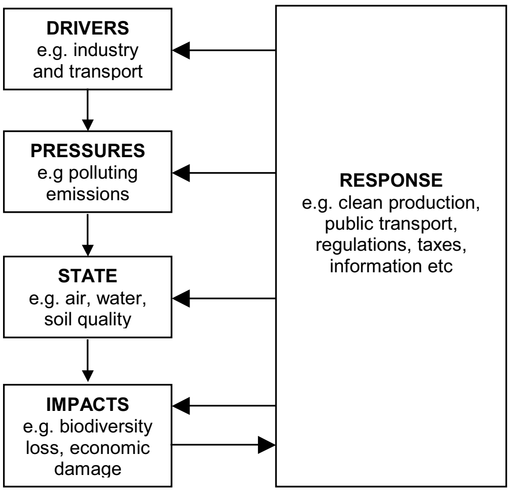


Figure 2. The DPSIR framework for reporting on environmental issues (EEA, 2002)

A combined framework

The Information Cycle model was especially designed to be applied to transboundary water management settings and collection and use of environmental information. The DPSIR framework, besides being a useful tool for organizing information about the environment, is also a widely known framework used by several international organizations, such as OECD and EEA.

In this study, we have chosen to combine the Information Cycle model with the DPSIR framework (see Figure 3). In doing so, we changed the name of the governing and initial step in the Information Cycle model from "water management" to "integrated river basin management". We consider this term more appropriate given the increased emphasis upon river basin factors and processes, both anthropogenic and natural, in understanding causes and solutions to water-related problems. This term also links quite explicitly to the Driving forces of environmental change (D) that lead to the direct Pressures on the environment (P) and the societal Responses (R).

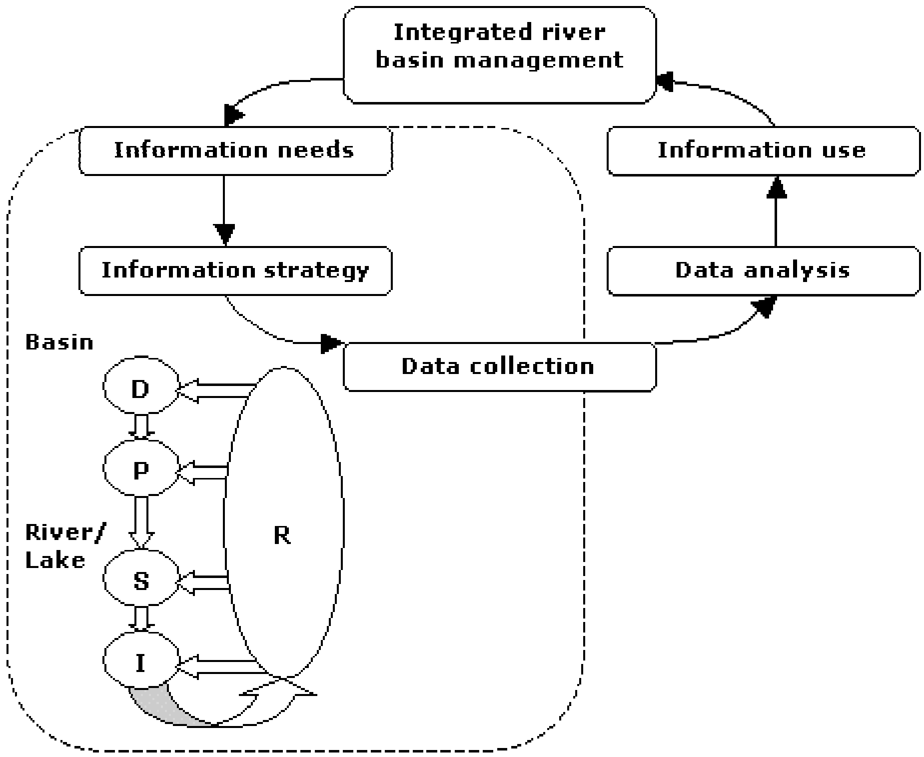


Figure 3. The Information Cycle model (Timmerman et al., 2000) combined with the DPSIR framework (EEA, 2002)

This combined framework was used as a basis for analysing some information-related activities of a formal transboundary water regime. The main questions explored were:

- What are the main reasons for collection, storage, analysis and use of environmental data and information?
- How are the information needs and strategies defined?
- What type of data and information is collected?
- How is it used?

The case of Lake Constance

The Lake Constance region

With a surface area of 570 km^2, Lake Constance is the second largest lake in central Europe after Lake Geneva (Figure 4). The drainage basin is about 11,500 km^2 and is shared between four countries, Switzerland with the Principality of Liechtenstein (50%), Germany (28%), Austria (21%) and Italy (0.4%) (Müller, 2001). The region is dominated by cultural landscape, even though forest makes up around 25% of the basin. About 1.5 million people live and work in the area (Living Lakes, 2001). Lake Constance is one of the most important drinking water reservoirs in central Europe, supplying water for more than 4 million people in Switzerland and Germany. The lake is also used for fishery and shipping. In addition, the lake attracts a lot of tourists to the region (Blatter, 2001).

During the last decades, the main environmental issue connected with water has been eutrophication of the originally oligotrophic lake. Already in the 1950s, the first signs of eutrophication were observed. In the 1960s, increased load of phosphorus was recognised as the main factor responsible for the deterioration. In the following decade, the phosphorus concentrations continued to increase. In order to prevent further pollution, channel systems and efficient waste-water treatment plants were built in the whole basin. A ban of phosphorus in detergents was also introduced. From the 1979 peak of 87 mg phosphorus/m^3 in the lake, the concentration has decreased steadily to today's level of 13 mg/m^3 (Schröder, 1999; Müller, 2001). Although direct or acute threats to the lake or the region are perceived, there are still some issues of concern. Clearly, there is a need for keeping the low phosphorus levels and therefore agriculture, increasing population, tourism and traffic are seen as potential environmental threats.

Figure 4. The Lake Constance drainage basin (Source: IGKB, 2001. Cartography by R. Obad, ISF, Langenargen)

Scope of the study

There are several actors, on various administrative and geographical levels, that take an active part in the management of Lake Constance and its basin. To gain more knowledge about the collection and use of environmental information in the management of the lake and its basin, ideally, this study should have identified the different actors and examined their roles and the communication and flow of information between them. However, due to time and budget limitations this could not be accomplished, at least not in a first round.

Instead we have chosen to focus upon the activities of the International Commission for the Protection of Lake Constance (Internationale Gewässerschutzkommission für den Bodensee, IGKB), and especially upon their collection and use of environmental data and information. There are three main reasons for focusing upon the IGKB. Firstly, the IGKB is recognized as the central authority for the protection of Lake Constance (Blatter, 2001). Secondly, it can be regarded as a joint body, in line with the definition (Article 1) and the enumeration of tasks (Article 9) of such a body, given in the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, done in Helsinki in 1992. Thirdly, it will most likely play a major role in the implementation of the EU Water Framework Directive.

Method

The study was performed in October-December 2001 through semi-structured interviews with seven persons, all members of the IGKB. Because of the semi-structural nature of the interviews, the questions discussed at each occasion were not identical. However, some major questions were brought up at each interview. The collected data was analysed ad hoc (Kvale, 1997), i.e. different analysing techniques were used, in relation to the following categories - corresponding to the combined framework:

- Information needs and strategies;
- Data collection and analysis; and
- Information use.

In addition, background information on, e.g. the structure of the IGKB was provided by many of the interviewees. Other sources of information, such as treaty texts, reports, meeting minutes and Internet material were also examined.

International Commission for the Protection of Lake Constance (IGKB)

Emergence of the IGKB

In November 1959, the bordering countries Austria (the federal state Vorarlberg) and Switzerland (the cantons St. Gallen and Thurgau), together with the German Federal States Bavaria and Baden-Württemberg, founded the International Commission for the Protection of Lake Constance (IGKB). The main reason for establishing the commission was the awareness of the increasing phosphorus concentrations in the lake. The phosphorus levels were, compared to future levels, moderate at the time, but scientists had already observed the increase of phosphorus and subsequent changes in phytoplankton biomass and composition. The politicians, on their side, rapidly understood the up-coming problem and the need for developing cooperation. Out of this, the IGKB emerged (IGKB, 2001).

Structure

The IGKB has a chairman and is composed of delegates from the member Governments (Figure 5). The delegates are not politically elected representatives, but experts with a background in technology or natural science. The commission meets at least once per year and the resolutions of the delegates are made by the principle of unanimity. The resolutions, on e.g. measures for phosphorus reduction, are given as recommendations to the bordering countries (IGKB, 2001). The bordering countries have, however, through the Convention on the Protection of Lake Constance Against Pollution (Article 6), committed themselves to carefully consider the recommendations of the commission and to implement them in the best possible way according to national law. A technical and scientific Board of Experts with attached working groups composed of representatives from scientific institutions and water and environmental protection departments from bordering countries serve as official consultants to the commission (Müller, 2001).

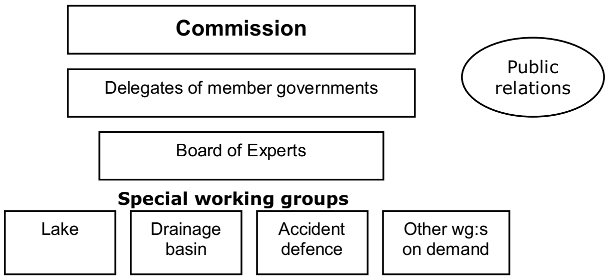


Figure 5. Structure of the IGKB (Müller, 2001)

Legal ground and main activities

The legal basis of the IGKB is the Convention on the Protection of Lake Constance Against Pollution, signed in 1960. The commission has the following main duties (Article 4) (Müller's (2001) translation):

- To observe the status of the lake;
- To confirm the causes of pollution;
- To recommend coordinated preventive measures; and
- To discuss planned utilisation of the lake.

The first 20 years, the IGKB mainly focused on the pollution of phosphorus in the lake. Its efforts, such as the building of waste-water treatment plants in the basin, resulted in a significant reduction of the phosphorus concentration in the lake (Blatter, 2000). Blatter (2000) further concludes that, "the joint activities to protect the water of Lake Constance represent one of the most successful environmental regimes in the world, measured in real impact".

Results and discussion

Information needs and strategies

The main reasons, according to the interviewees, for the IGKB to collect, store, analyse, and use environmental data and information are presented in Table 1, along with a categorisation, according to the DPSIR framework, of the type of data and information required to fulfil the tasks.

Table 1. Reasons for the IGKB to collect, store, analyse and use environmental data and information and the subsequent data and information requirements according to the DPSIR framework

Reasons for the IGKB to collect, store, analyse and use environmental data and information	Data and information required according to the DPSIR framework
Observe and agree upon the current status of the lake	S, I
Recommend preventive measures	R
Identify the causes of pollution	D, P
Discuss planned utilisation of the lake	D, P, S, I, R
Examine to what extent problems are still present and if measures have had the intended effect	S, I

The information needs, or reasons for the IGKB to collect, store, analyse, and use environmental data and information, as mentioned by the interviewees, are quite well defined, corresponding to the tasks stated in Article 4 of the Convention. The needed information can be said to primarily be defined with the IGKB own needs in mind, and with little consideration to information needs of other interest groups, such as stakeholders or the public. At least, the commission does not explicitly collect, store, analyse and use environmental data and information for reasons, such as raising public awareness. It can additionally be noted that there is only one stakeholder representative in the commission, coming from the Association of the Lake Constance-Rhine Waterworks (AWBR) and having a place in the commission's Board of Experts. Apart from this representative, there is no participation in the commission work of other stakeholder or interest groups.

The information needs and strategies are defined at the commission meetings, where the Board of Experts makes proposals for the commission delegates. As the delegates are highly educated technicians or natural scientists and thus experts themselves, although having the role of decision maker (or, rather, "resolution maker") in the commission, it makes little sense in this context to discuss the often lacking dialogue between information users and producers, as stressed by Timmerman et al. (2000).

Data collection and analysis

In categorising the data collected by the IGKB according to the DPSIR framework, it can be seen that the IGKB on a regular - yearly - basis collects, through monitoring, State and to some extent Impact information about the lake (Table 2). In addition, Pressure information on water quality and quantity of the tributaries is collected and data on point source emissions are provided to the IGKB by the Member States. Information on Pressures or Drivers, such as data or statistics on land use, population and traffic are not collected regularly. Considering the category Response, it might be worth clarifying this type of information - the societal response - a bit more thoroughly. Response information describes measures recommended, planned or taken to remedy the environmental issues of concern. Such information might be qualitative, recommending preventive measures, like building and investment programmes. But it might also be quantitative information, monitoring the implementation of the recommendations, such as the number of households connected to various types of wastewater treatment plants. In the case of the IGKB, it cannot be said that the commission regularly collect this latter type of Response information.

Table 2. Types of data collected on a regular (yearly) basis by the IGKB according to the DPSIR framework

Category according to DPSIR framework	Data and information collected on a regular basis
Driving forces	Not collected on a regular basis.
Pressures	Data on water quality and quantity of the tributaries. Data and information about number and kinds of waste-water treatment plants and emissions of phosphorus and nitrogen are received from the bordering countries.
State	Data collected through monitoring of physical, chemical and biological parameters at six stations in the lake.
Impact	Although not very explicit, data and information collected through the monitoring in the lake of course say something about impacts. In the yearly so-called "green reports", measurement data from 1961 up to today are presented and this, naturally, describes the impacts on the limnological system.
Response	Not collected on a regular basis.

In addition to the regularly collected data and information, the IGKB occasionally performs case studies on special topics. The results from these case studies are published in so-called "blue reports". By examining the publication list of the IGKB (IGKB, 2001), containing 52 records from 1963 to 2000, and by classifying, on the basis of the title, the publications into the classes Driving forces, Pressures, State, Impacts, and Responses, an attempt was made to categorise the studies performed more occasionally. The result from the classification is presented in Figure 6.

In conclusion, the IGKB regularly collects State and Impact information. Less effort, at least on a regular basis, is put on the collection of information on Drivers/Pressures and Responses. Thus, more effort appears to be put on fulfilling the information needs "to observe and agree upon the current status of the lake" and "to examine to what extent problems still are present and if measures have had the intended effect" (State and Impacts) than the needs "to identify the causes of pollution" and "to recommend preventive measures" (Drivers/Pressures and Responses). It should, however, be noted that the IGKB, through their occasional case studies collects, examines and propose Pressure and Response information. Despite this fact, most of the case studies have - at least historically -been performed within the State or Impact fields. One may argue that unless the Convention text regarding the duties is changed to read "to observe the status of the lake (S & I), the factors and forces in the lake basin leading to this (D &P), and the effectiveness of recommended measures (R) ", substantial changes in the information collection priorities are probably not to be expected.

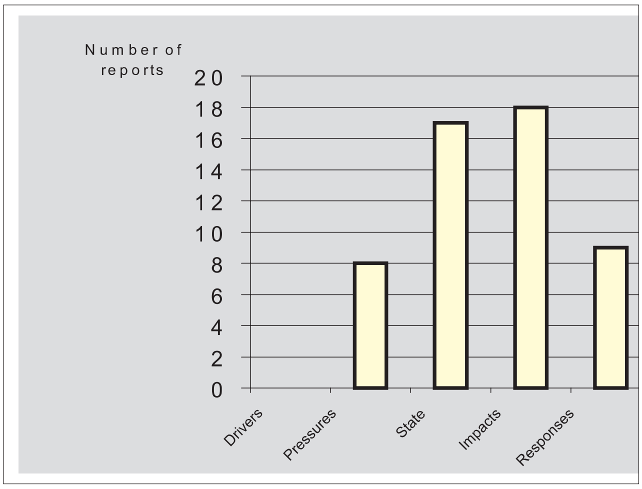


Figure 6. Classification of IGKB publications between the years 1963-2000 according to the DPSIR framework, on the basis of the titles of 52 "blue reports"

Data from IGKB monitoring programme are managed in databases and analysed, using e.g. statistical methods and geographical information systems (GIS). The results from the lake monitoring are presented in yearly so-called "green reports" and results from special studies are printed in "blue reports".

Information use

Information produced by the IGKB is mainly used for internal discussions and decision-making. Again, it makes little sense to discuss the communication of information between producers and users of information within the commission itself, due to the fact that there are no big differences between producers and users of information in this case. It can, however, be mentioned that all the interviewees emphasised the well working communication within the commission, between experts and delegates.

The main fora for communication with interest groups and the general public are:

- The newsletter Seespiegel, published twice a year;
- The IGKB homepage (http://igkb.de);
- Publications of green and blue reports; and
- Press conferences once a year in connection with the annual meeting.

More than half of the interviewees thought that the communication with the public, as it is today, is insufficient and not very well developed. Most of the "communication" should rather be classified as dissemination, i.e. spreading of information. The information in the green and blue reports was mentioned as being far too complex and technical to be understood by politicians and the public. The newsletter and the homepage are easier for non-experts to understand; still, they are "passive channels" of communication. More of a platform for communication is then the press conference held every year at the annual meeting.

Concluding remarks

This study has suggested a "new" framework for analysing some aspects on the collection and use of environmental information in integrated river basin management. This framework combines two existing ones, the Information Cycle model that specifies the main steps in management-driven water/environmental information activities and the DPSIR framework that specifies a structure for the types of information required when dealing with complex environmental issues.

This "new" framework was used to examine certain aspects of the data and information handling of the International Commission for the Protection of Lake Constance (IGKB), an international water commission with more than 40 years of cooperation and by many considered a very successful one.

Some main findings of this study are:

- The information needs of the IGKB are quite well-defined, requiring data and information on Driving forces, Pressures, State, Impacts as well as Responses. The information needs are defined with the commission's own needs in mind and with little considerations to needs of other interest groups;
- More efforts appear to be put on collection of information on State and Impacts than on Drivers/Pressures and Responses;
- The dialogue between information users and producers within the IGKB functions well. Thus the communication gap between producers and user of the information, as stressed by Timmerman et al., (2000) does not exist. One reason for this is because the (main) information users, the commission delegates, have themselves considerable technological and natural science expertise and are thus on the same "level" of the experts producing the information;
- If the commission in the future wish to strengthen its interactions with various stakeholder and interest groups, as indicated by several interviewees, it is reasonable to assume that new information needs will have to be defined and new fora and mechanisms for communication developed.

References

1. 1962. Übereinkommen über den Schutz des Bodensees gegen Verunreinigung. Gesetzblatt für Baden-Württemberg (1): pp. 3235-3237.
2. Blatter, J., 2000. Emerging Cross-border Regions as a step towards Sustainable Development? Experiences and Considerations from Examples in Europe and North America. International Journal of Economic Development 2(3): pp. 402-439.
3. Blatter, J., 2001. Lessons from Lake Constance: Idea, Institutions, and Advocacy Coalitions. In Blatter, J. and Ingram, H. editors. Reflections on Water: New Approaches to Transboundary Conflict and Cooperation. MIT Press, Cambridge, Mass., pp. 89-122.
4. Cunningham, G., 2000. Global Change of Infoterra to UNEP-Infoterra: Enabling countries to build an integrated environmental information service. Paper presented at INFOTERRA 2000 - Global Conference on Access to Environmental Information, 11-15 September 2000, Dublin, Ireland. http://www.unep.org/infoterra/infoterra2000/.
5. Dinar, A., 1998. Water policy reforms: information needs and implementation obstacles. Water Policy 1(4): pp. 367-382.
6. EEA, 2002. European Environment Agency. Accessed 3 January 2002. http://org.eea.eu.int.
7. Enderlein, R. E., 2001. Bilateral and multilateral cooperation under the Water Convention. Presentation at the workshop Environmental Status and Assessment of 10 Transboundary Rivers in Europe, 9-10 April 2001, Prague, Czech Republic.
8. IGKB, 2001. Seespiegel Informationen rund um den Bodensee. Accessed 15 May 2001. http://seespiegel.de.
9. Kvale, S., 1997. Den kvalitativa forskningsintervjun. Studentlitteratur, Lund.
10. Living Lakes, 2001. Issues at Lake Constance. Accessed 16 March 2001. http://www.livinglakes.org/bodensee/.
11. Müller, H., 2001. Lake Constance - a Model for Integrated Lake Restoration in International Cooperation. *In* Sund, H., Stabel, H.-H., Geller, W., Xiaogan, Y., Kechang, Y. and Fengning, S., editors. Environmental Protection and Lake Ecosystem. China Science and Technology Press, pp. 345-356.
12. Savenije, H. H. G., and van der Zaag, P., 2000. Conceptual framework for the management of shared river basins; with special reference to the SADC and EU. Water Policy 2(1-2): pp. 9-45.
13. Schröder, H. G., 1999. Lake Constance: Role of the International Commission for the Protection of Lake Constance. Presentation at the International Workshop on Management and Sustainable Development in International Lake basins, 16-17 December 1999, Tartu, Estonia.

14. Timmerman, J. G., Ottens, J. J., and Ward, R. C., 2000. The Information Cycle as a Framework for Defining Information Goals for Water-Quality Monitoring. Environmental Management 25(3): pp. 229-239.
15. UNECE, 1996. Protection of Transboundary Waters. Water Series No. 3, United Nations, Geneva.

Interviews

Thomas Blank, Amt der Vorarlberger Landesregierung, Bregenz, Austria. 7 November 2001.
Christian Gehring, Ministerium für Umwelt und Verkehr Baden-Württemberg, Stuttgart, Germany. 13 December 2001.
Peter Michel, Bundesamt für Umwelt, Wald und Landschaft, Bern, Switzerland. 7 December 2001.
Helmut Müller, Landesanstalt für Umweltschutz Baden-Württemberg - Institut für Seenforschung, Langenargen, Germany. 7 November 2001.
Franz Oberleitner, Bundesministerium für Land- und Forstwirtscahft, Umwelt und Wasserwirtschaft, Wien, Austria. 8 November 2001.
Gerd Schröder, Landesanstalt für Umweltschutz Baden-Württemberg - Institut für Seenforschung, Langenargen, Germany. 7 November 2001.
Benjamin Sollberger, Bundesamt für Umwelt, Wald und Landschaft, Bern, Switzerland. 10 December 2001.