WHO Collaborating Centre for Health Promoting Water Management and Risk Communication
Institute for Hygiene and Public Health
University of Bonn
Director: Prof. M. Exner

# WaMRi-Newsletter

No. 8, August 2005

Dear Reader,

water is the most essential resource for life on earth, it is crucial for relieving poverty, hunger and disease and critical for economic development (UN Department of Technical Cooperation for Development). Due to inequitable use, pollution, deforestation, desertification and climate change, water is becoming the most acute limiting factor to socioeconomic development. The lack of drinking water is the most serious global problem of humankind and the main cause of conflicts among countries. At present, more than 1 billion people have no access to safe drinking water. Against the background of a constantly growing world population, the coverage of an increasing need of freshwater for the future is the biggest challenge worldwide. The United Nations forecast that in 20 years, 3.4 billion people will live in countries with water shortage. Therefore, an effective water management and the supply with safe drinking water are of high importance not only in water scarce regions, but also in industrialised countries.

This issue of the WaMRi-Newsletter deals with an international project focussed on the global water system, provides information on the possibilities and areas of GIS application in the framework of the WHO Water Safety Plan and summarizes the main findings of the ECOSAN Conference, which took place in Durban, South Africa, in May this year.

We would like to inform you that the authors are responsible for the content
of their articles and that they do not reflect the opinions or positions of the WHO CC.

## Content



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# The Global Water System Project – A project of the Earth System Science Partnership

Marcel Endejan

## The Global Water System

Water is essential to life on earth, plays a key role in the development and functioning of society and is recognised as a high priority resource for sustainable development. Over the past few decades, environmental science has produced insights into various human, physical, biological and biogeochemical facets of the water cycle that makes up the global water system. The global water system is being transformed by major syndromes including climate change, erosion, pollution and salinisation (see Fig. 1). Although human-induced changes to the water system are now global in extent, we lack an adequate understanding of how the system works and responds to disturbances, and how society can best adapt to rapidly-evolving new system states.

1 Hydrological cycle accelerated
2 Mountain snow/ice lost
3 Trees removal increases runoff, reduces transpiration, affects water table and landscape salinity
4 Wetlands dried up or drained
5,6 Ground- and surface water used for irrigated agriculture
7,8 Dams alter flow and reservoirs increase evaporation
9 Industrial water coolers release water vapour
10 Transfers between basins
11 Urban, mining and construction areas alter water flows and quality
12 Coastal salt water intrudes inland
13 Impoundments reduce flows
14 Siltation, erosion and nutrient flows change coast-lines and affect water quality
15 Levees and locks modify flows and channels
16 Settlements alter floodplain landscapes
17 Grazing affects runoff and water quality
18 Industry causes acid rain
19 Coastal waters polluted and species lost

Figure1: Examples of major human-induced perturbations to the global water system (numbers refer to the list given on the right-hand side). Source: Vörösmarty et al., 2004. Humans Transforming the Global Water System. Eos, Transactions, American Geophysical Union, 85:48 (30 November 2004).

## The Global Water System Project – Questions and Themes

The Earth System Science Partnership has created a new research project to address these problems: the Global Water System Project (see box). The *overarching question* of the Global Water System Project (GWSP) is how human actions are changing the global water system and what are the environmental and socio-economic feedbacks arising from the anthropogenic changes in the global water system. *Three core questions* follow from this overarching question, and these questions make up the three major research themes of the GWSP.

The first question is '*What are the magnitudes of anthropogenic and environmental changes in the global water system and what are the key mechanisms by which they are induced?*' The activities related to this theme aim at the documentation and attribution of the global water system and will include examinations of the relationships between the global water system and water governance, land cover changes, climate change, water diversions, and nutrient and sediment transport.

The second question is '*What are the main linkages and feedbacks within the Earth system, arising from changes in the global water system?*' Related activities include studies of the linkages at different spatial scales in the global water system, arising for example through the international trade in virtual water, and studies of the legacy of human and natural interactions in the global water system. The goal of this theme is to gain a holistic understanding of the global water system.

The third question is '*How resilient and adaptable is the global water system to change, and what are sustainable management strategies?*' Related studies will deal with water requirements for nature and humans, the nature of the adaptive capacity of the global water system and approaches to enhance the capacity and the provision of ecosystem goods and services by the global water system.

The aim of this theme is to understand implications for the future and to inform policy and decision makers.

**Health-Related Issues in the Global Water System Project**

Many diseases are either water-borne, water-based, or caused by insect vectors living primarily in water. Hence, clean water and sanitation are essential to reducing the spread of disease and the vulnerability of people to disease. Changes in the global water system will undoubtedly affect the geographic coverage of various diseases and human vulnerability, although it is unclear what these impacts will be. In this research area the GWSP will work on improving our understanding of these impacts with colleagues in the newly established 'Global Change and Human Health', which is another joint project of the Earth System Science Partnership, as well as other research programmes.

**Fast-Track Activities**

At the first meeting of the GWSP Scientific Steering Committee in February 2005, a list of so-called 'Fast-Track Activities' has been defined. The list includes the development of a world-water atlas (including the development of indicators and an improved estimation of the world water balance); the organisation of a workshop on key issues of the global governance of water; the development of water and agriculture scenarios of the Brahmaputra-Ganges region; the organisation of an advanced (educational) institute for regional and global water researchers; and case study implementations in cooperation with other initiatives.

**Further information**

Detailed information about the GWSP can be found in the report 'GWSP Science Framework and Implementation Activities', which is available on the GWSP website (www.gwsp.org). The website also provides the project's newsletter 'Global Water News', selected publications, a list of all members of the scientific steering committee, and other information, for example on GWSP related meetings.

**Get in contact**

If you want to get more information, or if you want to contribute to the activities of the project described in the GWSP Framework Document, or the fast-track activities, you are welcome to get in touch with the International Project Office (see contact information).

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**GWSP Governance and Focus**

The Global Water System Project (GWSP) is a joint project of the Earth System Science Partnership (ESSP) consisting of four Global Environmental Change Programmes: the International Geosphere- Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), the World Climate Research Programme (WCRP) and DIVERSITAS, an international programme of biodiversity science. In the Scientific Steering Committee of the GWSP, which consists of eminent scientists from Africa, Asia, Australia, Europe, South America, and the USA, various scientific disciplines are represented. The project implementation is co-ordinated by the GWSP International Project Office, hosted at the Center for Development Research, University of Bonn, Germany.

The GWSP is a science-driven project taking a global and broad temporal perspective on the world's freshwater, while being scientifically integrative, addressing gaps and collating results.

# A GIS-based Water Safety Plan as an instrument of risk management in German catchment areas

Ina Stalleicken

## 1. Project Background

As a result of the interaction between technical development, hygienic-medical monitoring and legal regulations, the German water supply system improved over the last decades and is now regarded as very safe. Following the international developments and the new WHO Drinking Water Guidelines (WHO 2004), a process-orientated concept for risk-, monitoring- and incident management will be developed and implemented in this study. The concept will be surveyed with special consideration of resources protection (first barrier of the multi-barrier system) and in turn, of the Water Safety Plan which adequately considers – beyond current framework of legal requirements – possible new hygienic-microbiologically relevant risks for drinking water supply. The development of a Water Safety Plan in the framework of risk-, monitoring- and incident management includes the application of Geographical Information Systems (GIS). A main task of our study was to find out in which steps of the Water Safety Plan the implementation of GIS could be integrated as useful, perhaps even essential tool.

## 2. The application of GIS in the context of the Water Safety Plan (WSP)

| Step | Description |
|---|---|
| 1 | Assemble the team to prepare the water safety plans |
| 2 | Document and describe the system |
| 3 | Undertake a hazard assessment and a risk characterization to identify and understand how hazards can affect the water supply |
| 4 | Assess the existing proposed system (including a description of the system and a flow diagram) |
| 5 | Identify control measures – the means by which risk may be controlled |
| 6 | Define monitoring of control measures – what limits define acceptable performance and how these are monitored |
| 7 | Establish procedures to verify that the Water Safety Plan is working correctly and will meet the health-based targets |
| 8 | Develop supporting programmes |
| 9 | Prepare management procedures (including corrective actions) for normal and incident conditions |
| 10 | Establish documentation and communication procedures |

In the present study, GIS was applied as an analysis and visualization tool in decisive steps of the Water Safety Plan. The detailed process of GIS-supported implementation included:

1. identification of local participants, their tasks and interactions as an essential part of risk management;
2. detailed ecological information of drinking water conditions in the catchment area;
3. hazard assessment of risks as well as the identification and monitoring of control measures.

The collected data were integrated in a spatial geo-database. The characterisation of the catchment area was carried out with the help of other data bases such as land use data, geology, hydrology and soil characteristics.

This process constitutes a requirement for hazard assessment. The availability of GIS analytical instruments is of great importance for the hazard identification and risk assessment. For instance, the risk potential of groundwater as well as the semi-quantitative risk assessment in the catchment area (e.g. by settlement, agriculture, etc.) could be determined through the analysis of data on hydrology and soil. The spatial analysis tools of GIS are very essential for the identification of the control measures (step 5) and establishment of systems for regular control and monitoring procedures (step 6), including interpolation methods for the spatial interpretation and modeling analyses of groundwater and source water.

The spatial analysis of the nitrate and chloride concentrations using the *Kriging interpolation* (fig. 1-3) could be mentioned as an example. By means of such geo-statistic methods, one could easily identify a spatial trend, which can be calculated from the existing sampling points.

An overall high amount of annual sampling points in the catchment area is beneficial for the data *interpolation* of individual parameters. It is not recommended to use *interpolation* with a too low density of sampling points. The required documentation in the context of the Water Safety Plan is strongly supported by GIS, both on the basis of readily alterable GIS projects or maps and by the implementation of Web GIS functionalities.

## 3. Examples of GIS application in the context of the Water Safety Plan

Some selected results of GIS supported implementation of the WSP are presented below. These results refer to two important key elements:

1. **Characterisation and assessment of the water supply system**, in order to determine whether the drinking water supply from catchment to consumer could all in all be provided with a quality that meets health-based targets.
2. **Assessment of the control measures in a drinking water supply system** responding to the health-based targets.

### Example 1: Characterisation and assessment of the water supply system

In the protection area, the water is exposed to different types of hazards from agriculture, urban area, traffic, etc.. On the basis of a land use characterisation, the risk potential for groundwater in the protected area was evaluated as semi-quantitative. (Fig. 1).

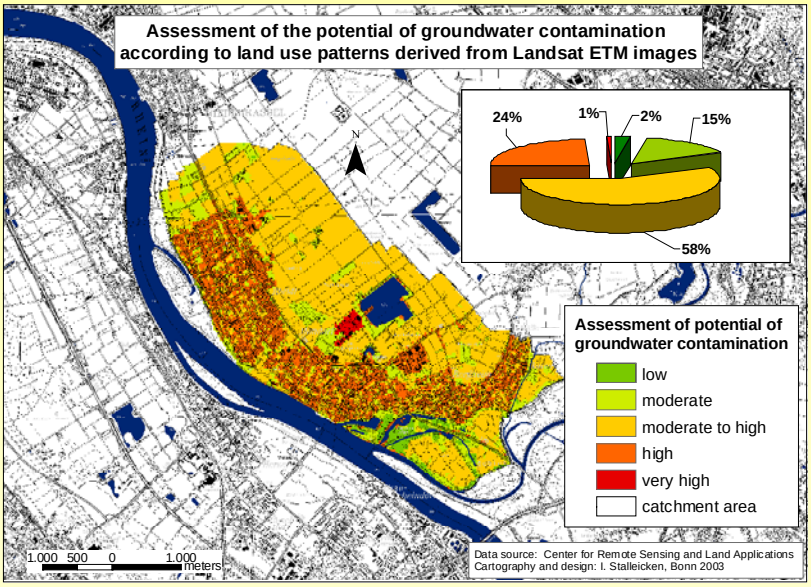


Fig. 1.: Assessment of the potential of groundwater contamination

Land use classifications of the Landsat ETM images (30 m raster) were attributed to the assessment categories, ranging from a low to a very high risk potential. About 58% of the protected area had a moderate to high, approximately 24% a high and 18% a moderate or low ground water risk potential. With the help of reclassification, the hazard categories were assigned according to the types of land use.

### Example 2: Assessment of the control measures

The assessment of limit values for the (critical) control points could be done by an identification of threshold values in the water protection area. On basis of the practice and experience, and in accordance with the Groundwater Memorandum 2004 (IAWR 2004), half of the drinking water limit values were defined as safety margin. "*These threshold values of maximal 50% of the drinking water limit also consider the long periods, until actions are implemented and current long-term trends are broken.*"(IAWR 2004). In the framework of the nitrate risk assessment, the catchment based risk index (CRI) was calculated on the basis of threshold values (= 25 mg/l, which equals CRI=1). Sanctions must be applied in the catchment area when CRI>1.

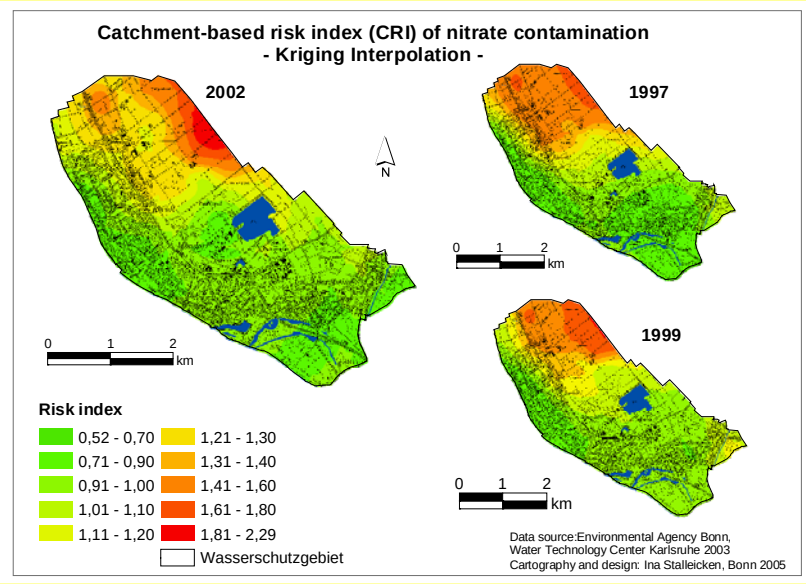


Fig. 2: Catchment-based risk index (CRI) of nitrate contamination

The CRI for selected years was calculated using *Kriging interpolation* (Fig. 2). Owing to the increased agricultural activities, the risk index was exceeded, especially in the northern part of the water protection area. The pollution of the groundwater by nitrate was regressing until 2002, due to the cooperation between agriculture and water supply sector.

The cooperation comprises advisory service for the farmers on the use of fertilisers, crop rotation as well as sampling of selected agricultural fields.

This collaboration revealed to be an important central measure which led in the last years to substantial reduction of the nitrate concentrations in the groundwater.

Variable groundwater flow conditions in the protected area are considerably affected by the water levels of the river, i.e. at a low water level, groundwater exfiltrates into the river, whereas when the water level in the river exceeds that of the groundwater, river water infiltrates into the aquifer. A qualitative groundwater deterioration by the infiltration of the river water can be determined on the basis of the GIS groundwater analyses.

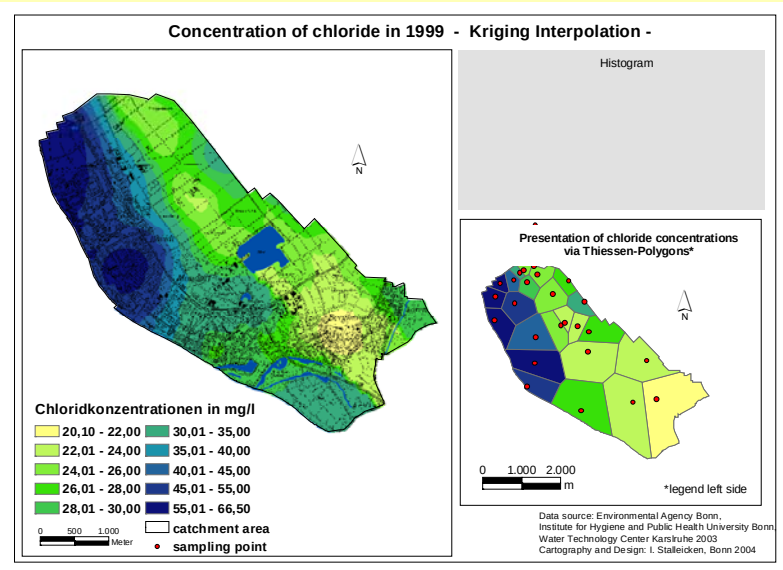


Fig.3: Concentration of chloride in 1999

Chloride is an important indicator for the interaction of groundwater and surface water which was extensively examined in the whole water protection area. Both the results of the interpolation and the representation of the chloride concentrations using *Thiessen Polygons* (Fig. 3) show increased chloride concentrations along the river. The influence of groundwater due to the infiltration of surface water was furthermore confirmed by an investigation with a X-ray contrast medium which could be used as indicator parameter for waste water and surface water influences.

The results of the *Kriging interpolations* presented here were verified by cross validating and standard error mapping (Stalleicken, 2004).

## 4. Final assessment

The present study is dealing with the possibilities and areas of GIS application in the framework of the Water Safety Plan. The substantial areas of GIS application in the context of the WSP are summarized in Tab. 1

**Tab. 1: Water Safety Plans (WSP) and GIS - areas of application in the framework of catchment area management (Stalleicken 2004)**

| Step | Description | Possibilities of GIS application | Assessment of GIS application | | |
|---|---|---|---|---|---|
| | | | low | moder ate | high |
| 1 | Assemble the team to prepare the water safety plans | - | - | - | - |
| 2 | Document and describe the system | Extensive catchment area characterisation on the basis of an extensive digital database, including Spline interpolation for the identification of the groundwater fluctuation, 3D visualisation of the groundwater stock | | | x |
| 3 | Undertake a hazard assessment and a risk characterization to identify and understand how hazards can affect the water supply | Extensive hazard assessment and a risk characterization via GIS application: Hazard types identification using the data on hydrology, soil and land use | | | x |
| 4 | Assess the existing proposed system (including a description of the system and a flow diagram) | | | | x |
| 5 | Identify control measures – the means by which risk may be controlled | GIS supported spatial analysis (including interpolation of the groundwater and raw water analyses) of individual critical control points; Implementation of calculations from groundwater models, Buffer functions, point density analyses, Probability Mapping for the identification of intervening values | | x | |
| 6 | Define monitoring of control measures – what limits define acceptable performance and how these are monitored | | | | x |
| 7 | Establish procedures to verify that the water safety plan is working correctly and will meet the health-based targets | | | x | |
| 8 | Develop supporting programmes | e.g. GIS training | - | - | - |
| 9 | Prepare management procedures (including corrective actions) for normal and incident conditions | Spatial analysis and visualization of long-time measurement results, spatial analysis of groundwater and raw water investigations, in particular trend analyses | | | x |
| 10 | Establish documentation and communication procedures | Maps, GIS project, Web-GIS application | | | x |

The application of GIS has already substantially facilitated assessment and characterisation of the water supply system. In the context of the Water Safety Plan, hazard identification and risk assessment in catchment areas of water supply systems are also substantially supported by GIS tools and simplified due to the varied possibilities of visualisation. Control and monitoring procedures are carried out via the existing GIS analysis instruments and contribute at the same time to documentation. Particularly, as they are already integrated in many areas of the water supply, spatial analysis methods make a substantial contribution to the control and monitoring procedures in the catchment areas. One precondition for the spatial analysis is however a sufficient number of sampling points in the water protection area- which was quite extensive, in this study- for selected chemical parameters (nitrate, chloride, sulphate).

**References:**

IAWR et al. (2004): Groundwater memorandum 2004. International Association of the Waterworks in the Rhine Catchment Area Cologne.

Stalleicken, I. (2004): Entwicklung und Implementierung eines GIS- und QRA-basierten Trinkwasser-Sicherheitskonzeptes (TSK) als Instrument des Risikomanagements in Trinkwassereinzugsgebieten. Zwischenbericht (unveröff.). Bonn

WHO (2004): WHO Guidelines for Drinking Water Quality. Geneva

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## Report on the Third International EcoSan Conference 23.-26.05.2005, Durban, South Africa

Stefan Deegener, Elke Müllegger and Andrea Rechenburg

**Introduction**

The 3. International EcoSan Conference was organized by Aussie Austin from the Council for Scientific and Industrial Research (CSIR) and took place at the international Congress Centre of Durban. 240 Participants from 27 nations took part in the conference.

Main topics were the achievement of the Millennium Development Goals by means of EcoSan, advances on the way to this achievement, development and implementation of technical solutions and the spread of the EcoSan-Idea in the population.

In order to halve the world population that live without access to any type of facilities for faeces disposal and at the same time offer ecological and sustainable methods for disposal of excrements until the year 2015, the issue of EcoSan-Projects has to be broached on political and institutional scale more intense than so far. The city of Durban serves as an example for this development, because more than 20.000 EcoSan toilet systems have been established by the eThekwini-City Council since 1997. Parallel to urine-separation-toilets, the participating households receive a 200 litre drinking water tank which is being filled for free once a day on behalf of the City Council.

The opening speeches at the conference showed that at the moment, mainly small, successfully implemented EcoSan-Projects exist worldwide. This has to be brought forward to bigger scale pilot studies in order to get active in the existing and upcoming high density areas and mega cities.

**Opening Session**

After the session opening by ***Aussie Austin***, the major of Durban held a speech in which he stated that the sustainable concepts are one main target in city planning. He aims to supply all 3 mio. inhabitants of Durban with sanitation, mainly dry toilets, until 2010.

The end of the session was accomplished by the Vice Minister of Science and Technology of South Africa, who emphasized the special meaning of Durban as an example region for the successful implementation of sustainable sanitation methods thereby characterising it as a perfect location for this conference.

**Excerpts from the Sessions**

***Christine Werner*** from the GTZ gave an overview of the implemention progress of "10 Recommendations for Action" which have been formulated at the last EcoSan Conference in Lübeck two years ago.

Subsequently, ***Susmita Shekhar*** (Sulabh International Social Service Organization) referred to the experiences with EcoSan in India. There, the use of human excreta in the own garden is being refused by great part of the populace.

***Yadira Codero*** (Efficacitas) from El Salvador emphasized the importance of the acceptance and enforcement of alternative sanitation concepts in the academic education, since most worldwide Universities teach only conventional water- and wastewater-management. From 1992 to 1994, 50.200 dry toilets have been built in El Salvador. Therefore, this country can be seen as a precursor of this technology. This idea, however, has only restrictively spread or not at all due to a lack of knowledge transfer.

***Almaz Terefe*** (Society for Urban Development in East Africa) from Ethiopia, who has long-time experience with EcoSan in her country, showed the special consideration of gender-related approaches especially on the level of planning and decision making.

***Neil McLeod*** from the eThekwini-administration reported about the efforts of supplying the 200.000 Durban families that are still without adequate sanitation. He was criticized that in South Africa, the urine and its nutrients seeps into the subsoil without being gathered and recycled.

**Street Theater**

A troupe from the eThekwini-water-agency performed an amusing and diverting play about the usage of dry toilets and waterless urinals as well as the handling and recycling of the collected products. In the play, the eldest son is coming to his rural home from town and is taught by his younger sister that dry toilets are nothing to be afraid of. It is shown that dry toilets do not smell and, if maintained properly, pose no health risk. The aim of this theatre is to increase the acceptance of waterless toilets in wide parts of the population.

**Fig. 1**: eThekwini Street Theatre

***Thor Axel Stenström*** (Swedish Institute for Infectious Disease Control) introduced the long expected "WHO-Guideline for Excreta Reuse" which will soon be published. This guideline could be the basis for needful laws and regulations on the reuse of urine and faeces.

***Arno Rosmarin*** (Stockholm Environment Institute), leader of the Swedish EcoSan research group, reported about a project in China, where a toilet has been designed, that „flushes" with ash, earth or sawdust instead of water, although it looks like a usual water flushing toilet. This could be an important step in promoting dry toilets, as they are often being labelled as old-fashioned and are neglected to water toilets.

In the parallel sessions, the presentation of ***Fabiola Garduños*** (Sarar Transformación SC) focused on the role of design and architecture in Ecological Sanitation Systems. She pointed out the importance of a user-friendly ecological design which is aesthetically pleasing, adaptable to the economic status of users and meets socio-cultural demands. The theoretical background was illustrated with examples from Mexico.

***Anne Richert Stintzing*** (VERNA Ecology Inc.) spoke about urine reuse in agriculture on municipal level. The project results were presented which had the purpose to establish a system for reuse of urine in Kullön, a housing area with 750 persons in Vaxholm, Sweden.

***Alberto Ysunza-Ogazón*** presented the environmental alternatives to sanitation and food sovereignty in Oaxaca, Mexico. The study was aiming at impacts evaluation of dry toilets regarding health impacts, usage, maintenance and recycling of excreta as well as perceptions of the human manure management.
The speech of ***Gertrude Matsebe*** (CSIR) with the title ”Is this a solution?” was verifying the impacts of urine diverting toilets in various regions in South Africa. Constructing dry toilets is not enough to help solving sanitation problems was the main finding of the study. For a successful implementation process the involvement of the local council, community participation, the involvement of service providers, training and post project support are crucial.

***Elke Müllegger*** (EcoSan Club) presented the case study ”Sanitation for a rural school in Uganda – a successful implementation process”. The importance of combining hardware with software in the implementation process is responsible for the sustainable improvement of the sanitation situation in ”Kalungu Girls Secondary School”.
***Elisabeth Kvarnström*** (VERNA Ecology Inc.) spoke about ”Swedish farmers attitudes towards reuse of digestion residues from anaerobic digestion and source-diverted urine”. The establishment of quality control systems is seen as an extremely important factor for the acceptance of Swedish farmers to reuse digestion residues and urine as fertiliser.

**Fig.2**: Demonstration of a urine separation toilet at the ”Kalungu Girls Secondary School”, Uganda.

The speech of ***Björn Vinnerås*** (Swedish University of Agricultural Sciences) had its main focus on the ”Fate of faecal pathogens and indicator bacteria in urea treatment”. The evaluation showed that storage is the simplest treatment method, but the biowaste has to be stabilized before to avoid odour, flies and rodents. Urea treatment seems to be the most efficient and safest compared to storage and biological treatment, regarding re-growth of pathogenic bacteria in a short term interval
”Guidelines for the safe use of urine and faeces in Ecological Sanitation systems” was presented by ***Caroline Schönning*** (Swedish Institute for Infectious Disease Control), which were published in the EcoSanRes programme. The guidelines provide general recommendation for treatment and safe use of human excreta for fertilising purposes.
”Developing strategies for the disposal and use of grey water in the non-sewered areas of South Africa” was presented by ***Kirsty Carden*** (University Cape Town). She was talking about a comprehensive study on evaluation of existing grey water management practises and recycling activities as well as water consumption habits in South Africa. Furthermore, Ms Carden pointed out the importance of properly managed grey water to reduce health risks.
***Stefan Deegeners'*** (TU Hamburg Harburg) speech ”EcoSan – a step towards sustainable rural development in Eastern Europe” focused on a pilot project for a Ukrainian school. The results of the project showed clearly that double vault urine diverting toilets are acceptable even for primary school children and that schools are an ideal location for promoting dry toilets rural and peri-urban areas.

**Field trip**
Pilot projects in the rural area of Durban were visited at a field trip, where the participants were able to see an urine separation toilet. These toilets are being built successfully throughout Durban and well accepted by the population.
Another visited project was a biogas plant in which human and animal excreta are being recycled. The plant was built more than one year ago as is being maintained by the owner independently since then.
The last visit was to the KwaZulu-Natal University, where the Pollution Research Group carries on a proving grounds for experiments about the usage of urine as fertilizer and experiments in the pathogen transfer from buried faeces into the surrounding earth.

**Post-conference seminar on agriculture and horticulture aspects of Ecological Sanitation**

***Håkan Jönsson*** (Swedish University of Agricultural Sciences) and ***Elisabeth Kwarnström*** (VERNA Ecology Inc.) were chairing the post-conference session on agricultural and horticultural aspects of Ecological Sanitation. The purpose of the seminar was to gather persons with experiences and/or interest in the reuse of urine and faeces for crop production, with a focus on network and exchange experiences of demonstration activities promoting reuse.

Keynotes were given by ***Peter Morgan***, who presented demonstration activities in the reuse of human compost and urine for growing crops under local conditions in Zimbabwe. The main focus of the presentation was on experiments demonstrating effects of vegetable growth by using toilet compost and urine as fertiliser.

***Leocadie Bouda*** from Crepa presented strategies to overcome cultural barriers challenging the reuse of human excreta in Burkina Faso. She described the current situation based on the local practises and various steps (like social mobilisation, domestic visits, demonstrations, etc.) to overcome these restrictions.

The last keynote presentation was given by ***Paco Arroyo*** (Sarar Transformación SC). He spoke about agricultural use of urine and faeces in Mexico and experiences with demonstration gardens and its acceptance by the local population.

The presentations were followed by group discussions, with a special focus on individual experiences in demonstration trials aiming to define five key bullets to answer the questions ”How to organise successful demonstration experiments?”. The seminar ended in the afternoon with presentations of group results in the plenum and final conclusions.

During the conference and the post-conference seminar it became very clear that still a lot of prejudices exist about the sanitation concepts of EcoSan. Questions about health risks, odour, maintenance of the system as well as about usability and prices are commonly asked by the population. There is still information missing about the die-off rate of many pathogens in EcoSan systems. Especially in Africa people are aware of HIV and afraid of using newly developed systems, because they fear infections. On the other hand many HIV-positive people could benefit from improved sanitation. Therefore, more research on disease transmission and health risks or benefits by using EcoSan is essential.

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# Special events on water, environment and health

## 2005

### 3rd IWA Leading Edge Conference on Water and Wastewater Treatment Technologies 06-08. August 2005, Sapporo, Japan

This conference is focused specifically on advances and developments in water and wastewater technologies. This conference consists of two parallel sessions: • Drinking water: membrane systems for drinking water, desalination technologies, natural organic matter removal, advances in disinfection, new adsorbents and adsorption processes, innovative treatment technologies • Wastewater: industrial wastewater treatment technologies, membrane bioreactors, novel reactors and technologies, nutrient removal and recovery, combined novel technologies for improved wastewater treatment, cost effective and efficient technologies for sludge management, simulation and modelling for improved wastewater treatment.

http://www.let2005.iwa-conferences.org

### 2nd Joint Specialty Conference for Sustainable Management of Water Quality Systems for the 21st Century 28.-31.August 2005 San Francisco, USA

Wastewater and water systems have historically played an important role in public health and, today, the role of these systems is viewed within the context of the entire water cycle, especially in light of the increasing use of alternative water sources and water reuse. At this conference, leading engineers and scientists from all over the world will exchange the latest findings and successful case studies highlighting new technologies, novel applications of established technologies, and innovative solutions to historical operational challenges and to emerging issues.

http://ica2005.re.pusan.ac.kr/

### Water, Health and Environment 2005 13.-15. September 2005, Tanta, Egypt

The first Regional conference on Water, Health, and Environment 2005 will present the most recent technological and scientific developments associated with health, water, environment, hydrology, ecology and all water related sciences. The conference is a good opportunity to bring together scholars, scientists, experts and researchers confronting end users, managers, decision makers and stakeholders from universities, institutes, agencies and authorities all over the world. They will discuss and develop a general framework to minimize and delay the increasing deterioration in water resources and ecosystems. The importance of this meeting cannot be overemphasized as water resources are increasingly polluted and contaminated. Water quality, contamination, remediation, restoration, purification, treatment technologies and water impacts on health, as well as other related topics, are essential to the future of the world public health.

http://www.cig.ensmp.fr/~iahs/conferences/2005TANTA.pdf

**European symposium on cyanobacteria and drinking-water**
**20.-21. October 2005 Reguengos de Monsaraz, Portugal**

To identify further action after a literature study, carried out by WHO/Europe with support from the German Federal Environment Agency, confirmed the regional relevance and the acute nature of cyanobacteria.

http://www.euro.who.int/eprise/main/WHO/Progs/WSN/WaterProtocol/20050317_2

**ENVIRO Asia 2005**
**09-11. November 2005, Singapore**

Initiating from its dynamic debut, Enviro Asia 2005 will be the Asian launch pad of the latest technologies, solutions, systems, equipment and services in all fields of environment management and technology comprising water treatment, waste management, air pollution control, clean energy, cleaning management and pest control integrated under one roof. The combined synergies generated by these 6 interrelated sectors showcase a spectrum of creative recycling concepts, resource efficiency and conservation, occupational and environmental protection, all of which reciprocate the fundamentals of recycling and waste management.

http://www.enviroasia.com.sg/home.html

## Links

**GLOBWINET - Global Water Information Network**
http://www.globwinet.org/default.asp

**IRC International Water and Sanitation Centre**
http://www.irc.nl/

**Development Gateway - Water Resources Management**
http://topics.developmentgateway.org/water

# Selected books and articles


- Ali, M.A., Al-Herrawy, A.Z. and S.E. El-Hawaary (2004): **Detection of enteric viruses, Giardia and Cryptosporidium in two different types of drinking water treatment facilities.** Water Research, **38** (18), 3931-3939.

- Ballance, T. and A. Taylor (2005): **Competition and Economic Regulation in Water.** The Future of the European Water Industry. IWA Publishing.

- Begum, S., Stive, M.J.F. and J.W. Hall (2005): **Flooding in Europe: Challenges and Developments in Flood Risk Management**. Springer.

- Butler, D. and F. Memon (2005): **Water Demand Management**. IWA Publishing.

- Carballa,M. et al. (2004): **Behavior of pharmaceuticals, cosmetics and hormones in a sewage treatment plant.** Water Research, **38** (12), 2918-2926.

- Cubillo, F. and J.C. Ibanez (2005): **Good Practices for Managing Risks of Scarcity in Water Supply**. IWA Publishing.

- Katsoyiannis, I.A. and I. Zouboulis (2003): **Application of biological processes for the removal of arsenic from groundwaters.** Water Research, **38** (1), 17-26.

- Merrett, S. (2005): **The Price of Water**. *Studies in Water Resource Economics and Management*. IWA Publishing.

- Monarca S. et al. (2004): **A new approach to evaluating the toxicity and genotoxicity of disinfected drinking water.** Water Research, **38** (17), 3809-3819.

- Ostfeld, A. and J.M. Tyson (2005): **River Basin Restoration and Management**. IWA Publishing.

- Schmoll, O., Howard, G., J. Chilton and I. Chorus (2005): **Protecting Groundwater for Health**. IWA Publishing.

- Singh, K.P. et al. (2004): **Multivariate statistical techniques for the evaluation of spatial and temporal variations in water quality of Gomti River (India)-a case study.** Water Research, **38** (18), 3980-3992.

- Stevenson, D. (2005): **Water Services Management**. IWA Publishing.

- von Sperling, M. and C.A. de Lemos (2005): **Biological Wastewater Treatment in Warm Climate Regions**. IWA Publishing.

- Wakida, F.T. and D.N. Lerner (2004): **Non-agricultural sources of groundwater nitrate: a review and case study.** Water Research, **39** (1), 3-16.


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