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University of Bonn - Institute for Hygiene and Public Health

WATER & RISK

Editorial:

Dear colleagues,
thanks to our new layout team, the WHO CC newsletter has changed its name and appearance. With issue No. 10, and after the first five years of publication, "WaMRi" has become "Water & Risk" – to be more convenient, more focused, and more appealing to our readership.

For the current issue, we invited several young colleagues to share with us their water & sanitation field experiences in India. We encourage you to follow Thomas Seyler, Patrick Sakdapolrak and Reena Singh to their PhD projects in Chennai and Delhi.

Christine Werner brings us insights into the engagement of GTZ in "ecological sanitation", a new paradigm in recycling-orientated wastewater management, and highlights the implementation of pilot projects in different parts of the world.

Reports from two conferences complete the newsletter: Andrea Rechenburg presents different disposal concepts from the Decentralized Infrastructure Conference (Aachen/Germany), and Susanne Herbst reflects on her impressions from the IWA World Water Congress (Beijing/China) on water, sanitation, health and the Millennium Development Goals.

We look forward receiving your comments, encourage you to contribute to future "Water & Risk" newsletters, and wish you a happy and successful 2007!

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Water and Health: Struggling for survival in a South Indian Megacity

The megacity Chennai, located in South India on the Bay of Bengal, is a fast-growing metropolis. The rapidly expanding information technology (IT) sector is establishing a wealthy urban middle class but there is also a growing vulnerable population which is forced to settle in marginal areas. Typically this population group does not have the capability to cope with the type of crises to which the people are frequently exposed. This is evident when water-related risks in Chennai are considered. People who live in slum communities are the most affected by the water scarcity with which the city regularly struggles. While high income groups consume as much as 300 litres of water per capita per day; the lowest income groups have to exist with only 16 litres per capita per day. They also pay a higher price for water than the higher income groups. Additionally, slum dwellers, whose settlements are often located in low lying areas and along riverbanks, are particularly affected by urban flooding caused by tropical cyclones during the monsoon. During such flooding, they not only lose their belongings, but are also affected by diseases such as malaria, filariasis, cholera, leptospirosis and suffer as a result of heavily contaminated drinking water.

Floods during the monsoon season, water scarcity during the dry months, contaminated drinking water, and lack of waste water facilities – embedded in this multifaceted water crisis the population of the South Indian megacity of Chennai is facing constant health threats. Two ongoing research projects on health in the megacity of Chennai are introduced here.

Figure 1: Chennai, India - a dynamically developing megacity (Source: P. Sakdapolrak)

The central hypotheses of the two projects presented below are two-fold: 1) that exposures to water-related stressors, health status and adaptive behaviours are socially dependent and spatially specific 2) that policies at the local level can be reinforced by taking these specificities into account.

Project 1: Spatial epidemiology of vector-borne diseases in the mega-city of Chennai, India: risk factors and water management strategies *(Thomas Seyler)*

Outline

Like any other megacity in a developing country, Chennai faces tremendous health challenges. In the category of water-related ill-health, some vector-borne diseases are emerging as new public health problems while others have been endemic for many years. In order to improve control and prevention of these diseases, a better understanding of their specific urban dynamics is necessary. The social and biological complexity found in large urban spaces requires a multidisciplinary approach to achieve this aim. This study focuses on water management practices as potential risk factors and, given the size of the city, attributes particular importance to the spatial dissemination of this risk.

Conceptual framework

Behavioural changes and the man-made transformation of the environment are particularly marked in the metropolis of Chennai. The city is a densely populated area with 7.5 million inhabitants, more than half of whom are concentrated on 160 km^2 of land. This is a heterogeneous space with intra-urban differences in residential segregation (Dupont 2004): in the type of habitat (Bunch 1997); in the level of infrastructure and in the provision of and access to health care. Human mobility is high, both within the metropolis and also between cities and villages in Tamil Nadu, India and the rest of the world. These three features - density, heterogeneity and mobility - should be taken into account when describing an urban disease in terms of population, time and space (Salem 1998).

Within the context of rapid urbanization and weak infrastructure, the issue of water management causes serious health threats. Studying vector-borne infections in urban areas and their risk factors inevitably leads us to enquire about the way private and public agents deal with water scarcity, water surplus and water quality. For example, the storage of drinking water in open containers for long periods provides ideal breeding sites for the vectors of Dengue, Chikungunya (*Aedes aegypti*), and Malaria (*Anopheles stephensi*); the poor maintenance of storm water drains leads to stagnating water with organic pollution that provides suitable breeding sites for the vector of Filariasis (*Culex quinquefasciatus*).

Research questions and methods

The process of urbanization in Chennai is far from homogenous. Some low lying areas are more prone to floods; some areas are still not connected to water pipes and get their water from wells. This implies, a priori, that there is an unequal spatial distribution of water-related health risks. Malaria, for example, is highly endemic in George Town, the historical and commercial city centre, whereas Dengue Fever cases are reported throughout the city. These intra-urban differences are worth studying from a public health perspective (Reiter et al 2003).

Figure 2: Breeding site of Anopheles stephensi, the urban vector of Malaria in Chennai, India (Source: Thomas Seyler)

The following research questions are posed: Where and when do infections occur in the city? What is the combination of risk factors that exposes populations living in different urban environments? To what extent can water management strategies be incriminated?

In order to test the hypothesis of intra-urban differences in health vulnerability and to identify the different combinations of risk factors, we selected 9 sentinel areas with different environmental and social characteristics. Along a transect starting from the historical centre of the metropolis (George Town) and ending in the peri-urban interface, the sentinel areas included intra-urban spaces such as slums, municipal housing and high-income residential areas.

Collected by a multidisciplinary team of medical entomologists, epidemiologists, health geographers, sociologists and virologists, data on urban and peri-urban environments, human populations, vectors, and infectious agents obtained in the different sentinel areas were linked together and integrated in a Geographical Information System (Arcview©) for data analysis. The database should provide an additional surveillance tool for the local public health agencies. It should also serve as the basis for the development of an urban early warning system for the diseases studied.

Outlook:

This study has led to the creation of a spatial database at the French Institute of Pondicherry that is regularly updated with data from the surveillance system of the Corporation of Chennai, including information on cases of Dengue, Chikungunya, Malaria, and breeding sites (overhead tanks, sumps, wells). There are two levels of analysis: the ward level (155 wards for the whole of Chennai city) and the household level for ward 48 (Elephant Gate) and the nine smaller sentinel areas. Additional efforts are currently being put into the collection of adult Aedes mosquitoes using a new type of trap.

Project 2: Adaptation behaviour and negotiating processes: How the vulnerable cope with water-related health risks in Chennai, India *(Patrick Sakdapolrak)*

Outline

The general objective of the research project is to enhance the understanding of health conceptions, health-related adaptation and the coping behaviour of a vulnerable population living with multiple water-related health risks in the megacity context. Water is essential for the survival of human beings fulfilling fundamental human needs, being used for drinking, personal hygiene and a wide range of other uses. Yet it can also be a source of risk for human health. Health is a crucial asset for the survival of vulnerable people, whose only asset is often their ability to work. As the first empirical analysis shows, impaired health leads not only to loss of income, but also creates a grave burden for the affected household in the form of medical expenses which they can not afford. Public health policies that seek to protect people from water-related health risks through improved risk communication need to understand and take into account the everyday health conceptions and health-related behaviour of the people.

Conceptual framework

The concept of vulnerability has become a central analytical category in the academic and practitioner's discourse on environment and health (IPCC 2001; WHO 2003; Bohle 2005). This project adopts the definition of vulnerability specified by Bohle, Downing & Watts (1994): "vulnerability is a multi-layered and multidimensional social space defined by the determinate political, economic, and institutional capabilities of people in specific places and specific times". It is argued that an understanding of vulnerability needs to be reached at the local level, that is at the level of social groupings, households and individuals. A particular challenge of vulnerability analysis, as Wisner (1993) emphasizes, is "to create ways of analyzing vulnerability implicit in daily life". In order to realize this aim, vulnerability analysis needs to be grounded in social theory that balances structure and agency, determination and freedom. This project seeks to explore how Pierre Bourdieu's social theory and his concepts of habitus, field and capital can be used as an analytical framework to enhance our understanding of vulnerability.

Research questions and methods

The project focuses on the health conceptions and health related behaviour of a vulnerable population. The main areas of interest are the coping and adaptive behaviour that is linked to water-related health risks. The research project explores the following questions: How do people conceptualise health? What do vulnerable people who are continuously threatened by water-related risks do to maintain and protect their health? What are the constraints and the enabling factors for coping and adaptation among vulnerable people? In what way is this coping behaviour a negotiated process and what is the result of the interplay between the interests of different players?

The aim of the project is to understand these health-related issues in the context of the everyday life of the vulnerable parties. Thus, qualitative research methodology is seen as an appropriate approach and is the guiding principle of the research design. The data is mainly produced through semi-structured interviews with individuals from typical slum neighbourhoods in Chennai; the participants being identified using theoretical sampling. The transcribed data is analysed with the help of QDA-Software.

Figure 3: Health risks through stagnating water during the monsoon in Chennai, India (Source: P. Sakdapolrak)

Status

The first field trip, which was co-financed by the Munich Re Foundation, explored the possibilities and limits of the research project, and preparatory surveys have been conducted. Since October 2006 the German Research Foundation (DFG) and the Federal Ministry for Economic Cooperation and Development (BMZ) have financed the cooperative project between the University of Bonn and Madras University.

Conclusion

Krafft et al. (2002) established that health is „the ultimate cross-cutting issue". This is especially the case in an evolving and complex urban setting, where multiple stressors in a complex socio-ecological system are at play. We feel strongly that the most effective way for our research effort to bring about action-oriented results is through a multidisciplinary approach and through close collaboration with local authorities to allow continuous feedback from professionals working in the field. The work on the epidemiology of vector-borne diseases will provide information on the risk factors in time and space, while the work on health conceptions and adaptive behaviour will provide ways to improve risk communication.

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A new approach to analyse water-related vulnerability in megacities: Delhi Case study

The expansion of the human population combined with the tendency of humans to gather in ever larger agglomerations has made human settlements the most dynamic patterns on the land surface. The potential of high resolution satellite imagery to help study the processes behind the observed patterns is significant. This paper describes the design of a recently launched project, which aims to evaluate the living conditions within different residential areas in Delhi, India. A combination of sophisticated methods of processing high resolution satellite imagery and analysing results from comprehensive social science field surveys is used to determine the water and wastewater related vulnerability of the population in different parts of the city due to changes in the physical, socio-economical, infrastructural and institutional environments. It is widely believed that upgrading the supply of water and sanitation can play a major role in improving the lives of the poor in developing countries.

Box 1: Working Definition of Vulnerability
"Vulnerability is defined as an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of potential harmful perturbations. It is a multilayered and multidimensional social space defined by the determinate, political, economic and institutional capabilities of people in specific places and specific times". It thus implies some external and internal dimension that may increasingly predispose people to risk (Bohle et al.1994, 2001, 2006).

Why study the megacity Delhi?

Delhi, with a population of over 14 million, is a growing megacity. High rates of immigration and a rapidly increasing population have increased the pressure on the existing infrastructure of the capital of India. Different kinds of residential districts accommodate this tremendous inflow of people, ranging from the Jhuggi Jhompri clusters (slums and squatter communities) to the planned settlements. About 50% of the population live in informal settlements and are plagued with inadequate infrastructure facilities and a number of water and wastewater related problems. Drinking water sources within the Delhi National Capital Region are also quite limited and depend to a large degree on agreements with neighbouring states, which form the basis for continual political conflicts. The

main sources of drinking water are the river Yamuna, groundwater, and open canals that transport water from distant artificial reservoirs. The amount of water available to the users is reduced by losses caused by leakages of about 40% in the ageing water supply system. There are significant differences in the regional distribution of water and sanitation services, depending, not least on the social status of the respective neighbourhoods. Frequent changes in water pressure within the public network during the day further weaken the system. Freshwater lines, which often run close to drains, are affected by the "siphon-effect", which is the intake of contaminated wastewater into the freshwater system due to a decrease in pressure (Krafft et al., 2003). Water and wastewater related problems in Delhi have numerous similarities with other cities, therefore making Delhi a classic case to be studied.

Aims and strategy:

The project 'Vulnerability in megacities: New approaches to analyse the urban water system in Delhi, India was started in early 2005 with the following major aims:

- To develop new methods to analyse high resolution satellite data and to use them in order to identify recent small-scale land use structures and their dynamics in megacities.
- To develop new algorithms for the detection of settlement dynamics from multi-temporal and multi-resolution satellite images with special emphasis on the recognition of housing structure, water and sewerage related infrastructure.
- To characterize and identify specific urban risk areas and the living quarters of vulnerable populations based on intensive field and household surveys.
- To find a linkage between remote sensing data and social analysis and to develop an integrated tool for vulnerability analysis.

Following the aims of the project stated above, an overall strategy was defined and tested for its suitability to improve the extraction of information on the vulnerability of the population living in the study area with special emphasis on the water supply and wastewater situation. The strategy is iterative and consists of the following steps:

1. Analyse very high resolution images to identify gradients of image settlement structures and to develop hypotheses for the relation of image settlement structures and living conditions.
2. Select test sites, which combine different types of image settlement structure and gradients between the types.
3. Conduct extensive household interviews in various localities within the selected test sites following the different textures in the images.
4. Analyse the levels of vulnerability of the social groups with respect to water and wastewater looking in particular at levels of human exposure and reported health effects in the selected sites.
5. Stitch a connection between the results extracted from the satellite images and the qualitative and quantitative analysis of the field survey.
6. If successful, evolve an integrated methodology for vulnerability assessment that can be transferable to other areas.

Study area:

Test areas were selected within Delhi with different social and settlement structures. Figure 1 shows the location of the test areas. The specific selection of test areas can be summarised as:

1. Central Delhi (Central District), which represents a mixed development trend and receives a comparatively greater share of the centralised water supply.
2. South Delhi (South District), which is more disadvantaged in terms of water availability due to depletion and the contamination of ground water.
3. Trans-Yamuna area (Eastern District), which is experiencing a mushrooming of lower and lower middle class housing complexes.

Test sites (C1, C2, E1, etc.) were selected within each test area following the gradient and differential textures on the images. For each test site, comprehensive field surveys were carried out based on household interviews, selecting samples from various types of residential quarters and the geolocation of water-related infrastructure such as canals, pipes, rooftop water tanks, ponds, public wells, etc. Further information was gathered using other observation techniques, digital photographs and GPS-receivers.

Database and methodology:

This project is an attempt to add depth to vulnerability study by interlinking remote sensing and social research data (Figure 2). The primary data collected in the field

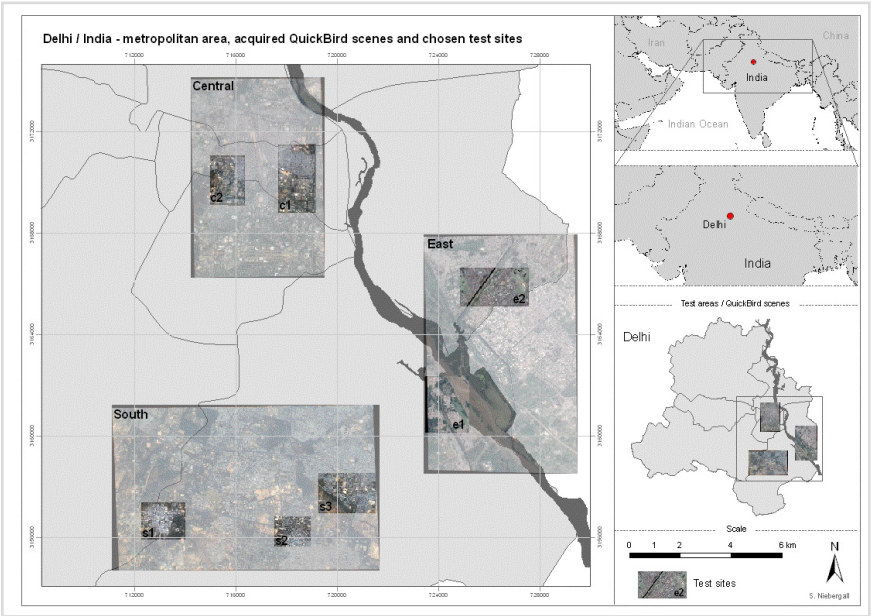


Figure 1: Map of Delhi with the three test sites chosen for the project shown as high resolution QuickBird images. Image courtesy by DigitalGlobe. Acquisition dates: Central: 20th of April, 2002, East: 19th of September, 2002, South: 18th of December, 2002.

through household surveys, field observations, and expert interviews are both quantitative and qualitative in nature. The analysis of this information, first follows the indicator approach to analyse the exposure component of vulnerability relating to water and wastewater. Additionally, information on land use, land cover, house density,,informal settlements (detectable by very fine texture in the images) and water infrastructure are extracted from high resolution remote sensing data and linked to the data from the household survey.

Conclusion:

This interdisciplinary approach attempts to integrate quantitative and qualitative social research with remote sensing data in order to develop a comprehensive framework for an objective evaluation of the vulnerability of the inhabitants of different residential areas in Delhi. Vulnerability in this case study is defined as the characterization of a person or social group in terms of their susceptibility to be harmed as a result of the existing weaknesses in the city's public services, in particular with regard to the existing water and sanitation system. Social groups are at varying levels of risk depending on their advantageous or disadvantageous location and their internal capacity to overcome these risks. The level of risk and exposure is higher in the informal settlements, which are characterized by the near absence of public infrastructure, high population density and narrow lanes which are easily flooded by sewer water (Figure 3). The availability of drinking water is also critical here as it is only available from community taps for very short and uncertain periods of time. Since the income level of people in such areas is low, they cannot avail themselves of costly water tanker supplies. The higher level of risk and greater exposure to water and wastewater related hazards is manifested in the higher prevalence of water-related diseases in such disadvantaged areas. Planned settlements, however, possessing comparatively better levels of civic facilities and higher income levels are at a medium to lower level of risk from water and wastewater related

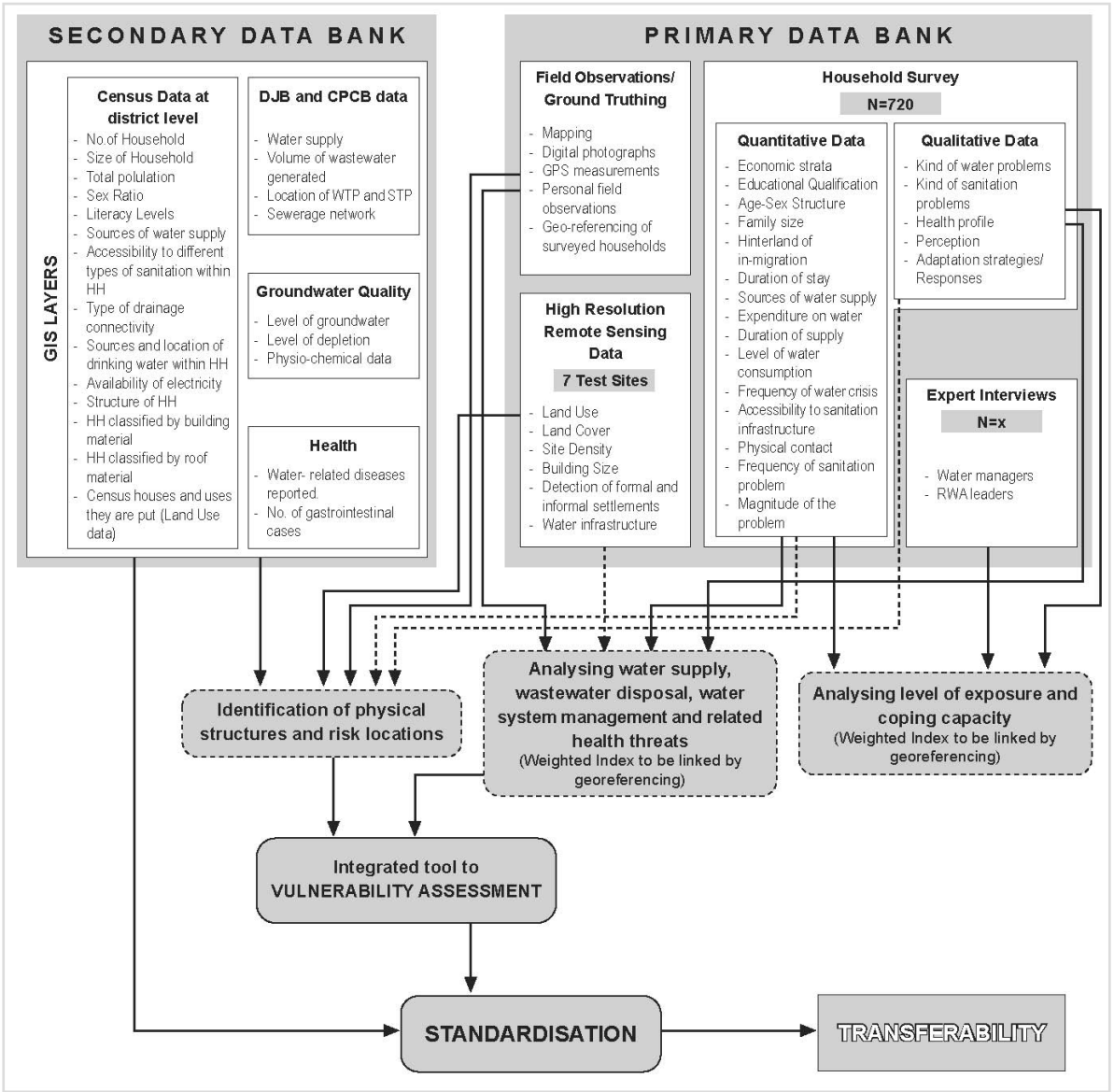
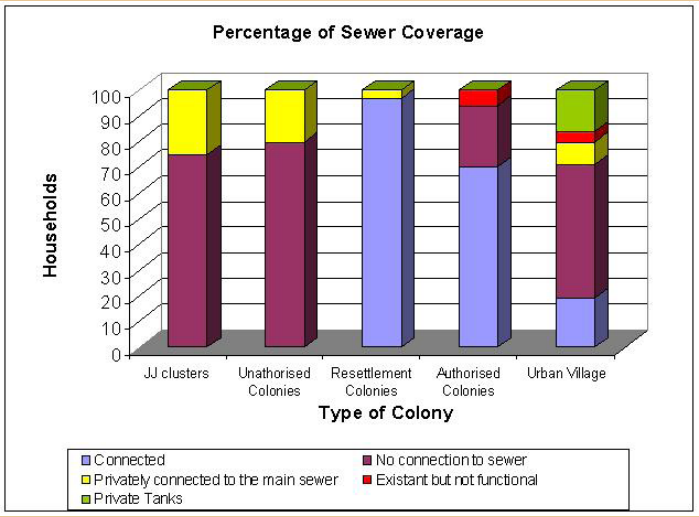


Figure 2: Interlinkages of remote sensing data and social research (HH: Households, WTP: Water Treatment Plants, STP: Sewerage Treatment Plants, DJB: Delhi Jal Board, CPCB: Central Pollution Control Board, RWA: Residents Welfare Association), Draft: R. Singh and group. Cartographer: Spohner, R.

Box 2: Lack of sufficient infrastructure

The rapid and uncontrolled growth of Delhi results in the constant neutralization of development and government efforts. A quantitative and qualitative undersupply of basic infrastructure particularly relating to water and wastewater is one of the major problems faced by citizens. In this respect certain types and degrees of vulnerability exist, in particular among the marginalized population. Informal settlement areas completely lack any provision of sewer facilities, although there is a water supply. Major parts of Delhi also suffer from ageing infrastructure. Formal and authorized residential areas also do not maintain required standards, due to a lack of infrastructure and inadequate maintenance. The internal and external conditions and processes responsible for increasing risk factors develop dynamically and need to be understood from different perspectives. This has required the development of new methodologies.



Source: Field Survey R.Singh, Feb-April, 2006)

hazards. Although water and wastewater related problems are not completely absent in these areas, people's awareness of such civic uncertainties and their ability to cope with them increases their resilience, placing them at a medium to low level of vulnerability.

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Figure 3: Human exposure to wastewater (Source: R. Singh, Delhi, 2006)

ECOSAN – recycling-oriented wastewater management and sanitation systems

Context

Ecological sanitation (ecosan) is a new paradigm in sanitation that recognises human excreta and domestic wastewater not as waste, but as a resource that can be recovered, treated where necessary, and safely used again.

Ideally, ecosan systems enable the complete reco very of nutrients in wastewater and their reuse in agriculture. In this way, they help preserve soil fertility and safeguard long-term food security, whilst minimising the consumption and pollution of water resources.

Conventional sanitation technologies are coming under increasing criticism for being economically and ecologically unsustainable. It is evident that the United Nations Millennium Development Goals (MDGs) cannot be achieved by conventional sanitation solutions alone and that alternative approaches are urgently needed.

The German Development Cooperation considers ecosan to be a new approach with high potential to resolve the pressing problems related to the global water and sanitation crisis and to help achieve the MDGs.

Approach

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), GTZ started an international ecosan research and development program in 2001.

The aim of the program is to establish ecological sanitation concepts as an internationally recognised innovative approach and to contribute to the improved sustainability of water and sanitation projects in development cooperation. The activities of the GTZ ecosan program include: collection, development and dissemination of knowledge and information on ecosan issues; support of the worldwide ecosan network; lobbying for and promotion of ecosan concepts and the implementation of ecosan pilot and demonstration projects.

Impacts

Since beginning work, the GTZ's ecosan program has gained an international reputation. Thanks to the efforts of GTZ and its partners, ecological sanitation is now emerging as a valid and promising sustainable solution in the international sanitation discourse.

GTZ has been instrumental in organising a number of major conferences that have catalysed the networking of international ecosan experts and initiated the strategic dialogue on mainstreaming ecological sanitation.

The information service of the GTZ ecosan program has proved to be very popular. A quarterly newsletter in five languages and the GTZ ecosan website provide extensive and up-to-date information. Publications such as the data sheets on ecosan projects and ecosan technologies make available experience from projects around the world.

GTZ has also contributed to the formulation of international guidelines relevant to ecological sanitation, including the guidelines for ecosan capacity building with UNESCO, and guidelines for the safe use of excreta and greywater by the WHO. The third edition of the WHO Guidelines marks an important departure from the presentation of static standards and norms to best practice guidance in risk assessment and management for the use of this increasingly important water, nutrient and energy resource. Now the Stockholm Framework provides the basis for establishing health-based targets, and the guidelines describe possible risk management interventions for the various phases from the generation of wastewater, excreta and greywater up to the consumption of products for which they are used. The new WHO guidelines are issued in four volumes, each with a different focus and target audience.

Ecosan systems and system components are comprehensively discussed in the WHO guidelines, and recommended as proven technologies for many situations. Volume 2 on "Wastewater use in agriculture", Volume 3 on "Wastewater and excreta use in aquaculture" and Volume 4 on "Excreta and greywater use in agriculture" are now available online at the WHO website.

Pilot- and demonstration project examples

GTZ is implementing pilot projects in Africa, Asia, the Middle East, Europe and Latin America. The aim of these pilot projects is to develop, test and adapt ecological sanitation technologies, organisational schemes and

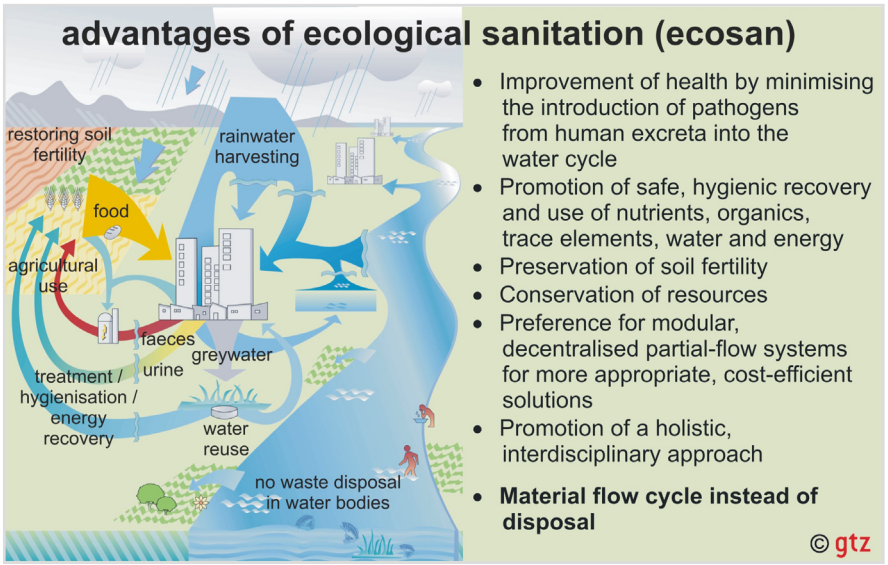

Figure 1: Advantages of ecological sanitation (Source: GTZ)

Figure 2: The ecosan concept has been successfully integrated in pro-poor peri-urban and urban agriculture programmes in Cagayan de Oro, the Philippines. (Source: Robert Holmer)

reuse concepts, and eventually to obtain showcases for demonstration, training and duplication.

In India, for example, a public toilet block has been installed in a slum area of Bangalore, providing clean sanitation services at low cost to poor inhabitants. Faeces and urine are collected separately and reused in the city outskirts for fertilising a banana plantation and for energy production in a biogas plant.

In Botswana, a community based project established ecosan urine diverting dry toilets for individual households. While urine is stored separately, faeces, organic waste and animal manure are treated together in a composting unit for sanitization. The safe recycling of excreta as fertiliser has improved agricultural productivity and ensures the protection of health and the environment.

In the Philippines, a model constructed wetland is more robust and better performing than conventional models, as it uses a regional plant variety. The wetland treats the wastewater from 715 households in a poor settlement, uses the treated water from the wetland to irrigate green areas in the town and is an integral part of the ambitious environmental programme of the city of Bayawan.

The ecological sanitation concept has also been successfully introduced to Cagayan de Oro City in the Philippines. New strategies based on prevention and health promotion within the WHO frameworks "Healthy Cities" and "Health Promoting Schools" have been introduced here to five urban poor communities and two elementary schools, through the establishment of urine-diverting dehydration toilets in allotment and school gardens of the city. These pilot projects are part of a holistic approach concerning public health, nutrition, food security and urban environmental planning implemented in a joint effort by the academy, the local government, the urban poor communities as well as the German Government through CIM (Centre for international migration und development), GTZ and the German Embassy.

The main building of GTZ's headquarters is located in Eschborn, near Frankfurt am Main, Germany and provides office space for about 600 employees. As part of the recently undertaken renovation work, GTZ has implemented here a modern system for the separate collection and reuse of urine and brown water (faecal matter mixed with flushing water). The direct aims of the project are to reduce water consumption, to minimise the emission of nutrients and micro contaminants such as pharmaceutical residues and hormones into the public sewer system and receiving water bodies, and to enable the recovery of nutrients for agricultural use and water.

The ecological sanitation system has been installed in the GTZ building to demonstrate the feasibility and the advantages of the system and to contribute to the global dissemination of the ecosan concept. The GTZ main building is particularly suitable for this type of demonstration project, as it is visited daily by a number of decision-makers from around the world.

As part of the project, GTZ, together with several universities and private companies, will carry out an accompanying research and development programme, with the aim of developing different treatment technologies for urine and brown water and a range of reuse practices, and to develop these to the point where they can be marketed. Crucial questions concerning user acceptance, the environmental and health impact of urine

Figure 3: Front view of the renovated main office of the GTZ, Eschborn, Germany (Source: Fa. ttsp-HWP-Seidel

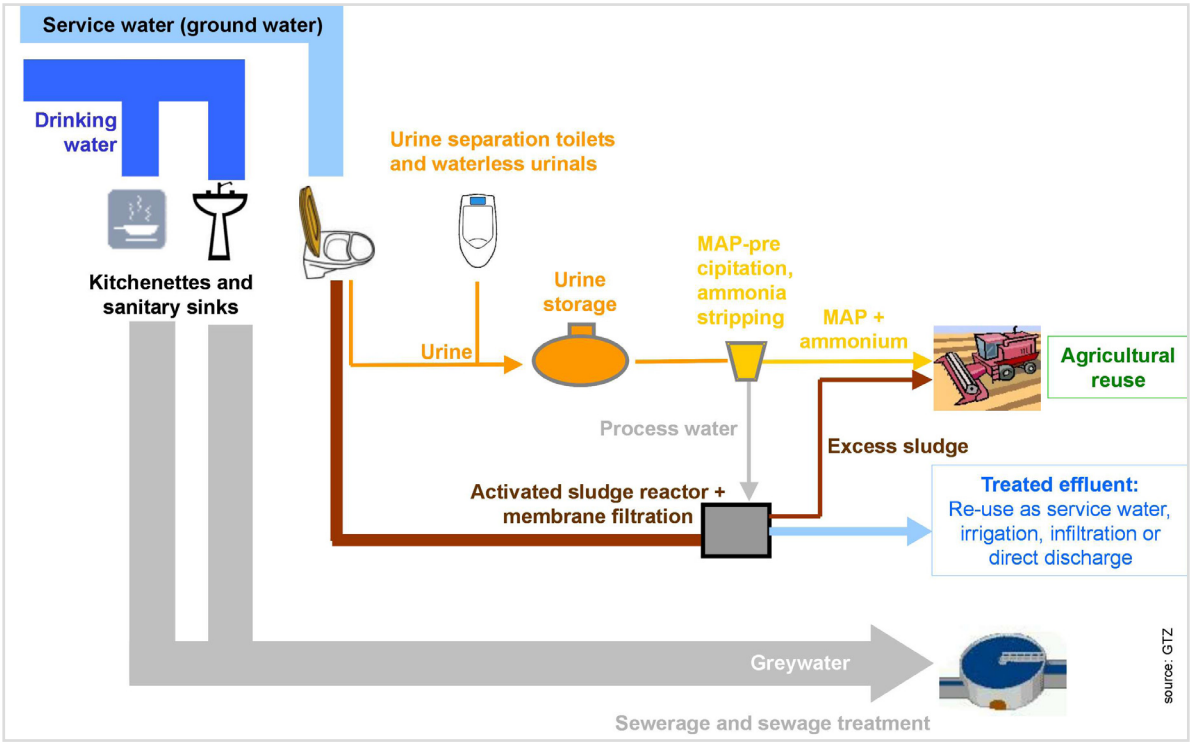

Figure 4: Flowchart of the ecosan system implemented at the GTZ main building (GTZ)

reuse, economics and resource efficiency, and the appropriateness of the regulatory framework will also be studied. The project offers a unique opportunity to research institutions and private companies to carry out applied research on real-scale concepts for closed-loop wastewater management.

With this, the GTZ is setting a clear signal of its willingness to use modern, future oriented sanitation concepts in its own building, to demonstrate their feasibility, and the important role they can play in sustainable resource management and in reaching the Millennium Development Goals for water and sanitation. The project implemented at the GTZ building and the sanitary systems at the KfW (German Bank for Reconstruction) banking group headquarters, in Frankfurt, Germany, complement one another: At the KfW, vacuum toilets and vacuum sewers have been installed to collect the black water, and grey water is recycled after mechanical, biological and membrane treatment, to flush toilets. With these two demonstration projects, the German development cooperation has increased its credibility when it comes to promoting ecological sanitation concepts in partner countries.

Outlook

In recent years many successful ecosan programmes have been implemented in different countries in rural and sparsely settled urban areas. A great deal of experience has been gained in these areas and a variety of solutions exist which can be recommended for wide-spread large-scale use in accordance with local physical, cultural and socio-economic conditions. Although initial experiences with ecosan systems are available from densely populated urban areas, further research and development is urgently required to gain the necessary experience in these more complex areas that would allow ecosan systems to be implemented on a large scale, to showcase the technical feasibility and the benefits of this new approach. In addition to this, there are several other challenges which need to be faced before ecological sanitation systems will be widely adopted:

- Awareness of the alternatives offered by ecosan has to be increased and large scale capacity building is required.
- Resource reuse needs to be integrated into sanitation planning processes from the very beginning.
- Legal frameworks and technical standards need to be revised.
- Full cost analysis and comparison of the environmental and health risks of all types of sanitation have to be established.
- Innovation-friendly investors are required, as well as new financing instruments supporting investment by private households.

However due to the huge potential of the ecosan concept, these challenges must be overcome and ecological sanitation should be recognised and introduced as a new, promising, holistic and sustainable approach to provide safe and decent sanitation, reduce poverty, contribute to food security, preserve our environment and maintain the natural basis of life, in industrialized, developing and emerging countries.

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Integrated approaches to supply and disposal systems

Worldwide water usage follows the scheme of extraction and restoration (Günther Klein, Federal Environmental Agency, Germany). In developing countries, water usage in the household is often associated with long distances to the nearest well, substantial costs and also water-related diseases. There is also a lack of sustainable usage of waste water and waste, from which, for example, plant fertilizer and biogas for energy production could be generated. This would significantly improve the living conditions of many people. Even though these problems seem distant to Middle-Europeans, here also, more efficient water usage and the recycling of waste water or waste could contribute to sustainable development. Additionally, as a result of expected demographic changes, new planning concepts are important, to be able to provide cost-efficient infrastructure on a small scale l.

Contribution from the "Aachener Kongress: Dezentrale Infrastruktur Wasser - Energie - Abfall", 17 - 18. October 2006 at the Eurogress Aachen, Germany

The conference 'Decentralized Infrastructures', which took place in October 2006 in Aachen, brought experts on this topic together, who reported on both traditional and new approaches. Key themes were disposal concepts within the two thematic blocks 'small-scale sewage treatment plants' and 'new sanitation concepts'. Within this newsletter, three projects are presented as examples from the BMBF (Ministry of Education and Research) research funding focus on 'Decentralized Water Supply and Disposal Systems'. The 'MODULAARE'-Project uses decentralized waste water and waste treatment to produce regenerative energy in a hotel in Turkey. The University of Stuttgart provides the scientific management and technical implementation is in cooperation with private sector project partners. The primary goal is to set up a decentralized system to recycle as much of the waste produced in a tourist resort as possible. Furthermore, it emphasizes synergy effects resulting from recycling products and closed cycles. Using a membrane batch reactor and a fermenter it is possible to run an almost 'wastewater free' hotel that additionally produces energy and fertilizer for public parks. This technique could minimize waste originating from tourist resorts and as a result, help tourist destinations to be kept free from waste dumps and seawater pollution and make a great step towards sustainable tourism.

Another funded project representing ecological recycling management is the extension of the Valley-View University in Accra, Ghana. The Valley-View University is a private university, which has been extended with the

Figure 1: Decentralised-infrastructure conference in Aachen (Source: http://www.dezentrale-infrastruktur.de/)

concept of sustainability in mind. Being a research and development project, German universities and companies, staff of the University of Accra and nearby farmers are integrated into the project. The objective is an ecological in-a-box concept that includes technical arrangements, extension and renovation of the buildings, capacity building and quality assurance management. Apart from rain water usage, the grey- and yellow water produced in student dorms and canteens will be recycled in order to use any available resources. In the long run, the concept should break even and serve as a demonstration project in the region.

Both projects have shown the importance of explaining new technical equipment or new applications and their advantages to users. Only in this way, prejudices can be fought and a wider acceptance achieved. In Accra, for example, the use of yellow water as an organic fertilizer was shown to the surrounding farmers. After initial scepticism, the application of urine is now accepted by the farmers, but still the use of black water is rejected.

In Germany, too, experience exists in the operation of small scale sewage plants and the usage of rainwater. An example of an integrated system in Germany was presented by Professor Trösch in his talk on semi-decentralized infrastructure in a study area in Knittlingen near Stuttgart, Germany (Project DEUS 21). The focus is on minimizing the infrastructure for disposal of wastewater and the use of rainwater. The houses are equipped with vacuum toilets. Shredded biodegradable kitchen waste is disposed via the central vacuum system and channelled to a semi-decentralized anaerobic operated sewage plant. The end products of this plant are biogas, nitrogen and phosphor in form of MAP-fertilizer and a little remaining sludge. The discharge of the sewage plant is passed through a filtration unit to achieve bathing quality water.

Rain water is cleaned using rotating ceramic disc filters. According to the first research results, this produces water of drinking quality. This is used in washing and dishwashing machines, as well as for showering. Before such technologies can be implemented on a large scale basis, further scientific research is needed, showing the hygiene and environmental safety of these systems and the substrates produced. The use of rain water for the above-mentioned purposes can be seen critically from the hygienic-medical point of view. 'Water for human consumption' has to be tightly controlled in Germany and the EU to protect the public from health threats. At the moment, no data exist concerning the quality of rain water treatment during long term operations and it is unclear how a hazard management plan has to be designed. Here, the cooperation of planners, engineers, hygienists and decision makers is absolutely necessary.

Figure 2: Waterless urinal (Source: A. Rechenburg)

Obviously, there is a demand for decentralized and semi-decentralized supply and disposal systems, in particular in less densely populated areas and as a result of demographic changes. Scientists from differing backgrounds agree that both centralized and decentralized infrastructure should exist side by side and the preference for one system over another has to be based on the existing conditions. Experts with knowledge of a broad range of infrastructure systems are needed, who will chose according to the situation the most sustainable system from the spectrum of systems available; from rain water usage and waterless diverting toilets to supply structures with a centralized drinking water supply and sewage system.

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Figure 3: The historical Lambertsmill - a watermill, where decentralized waste water management is practiced.(Source: A. Rechenburg)

Water, Sanitation, Health and the MDGs

Contribution from the 5th International Water Association World Water Congress and Exhibition, 10 – 14 September 2006 at the Beijing International Convention Centre, Beijing, China

The links between water, sanitation and health go far beyond the technical aspects of water and waste water treatment. International conferences often focus on the purely technical aspects of water and waste water treatment and even neglect the aspect of sanitation and its linkages with water. For that very reason, it was important that the International Water Association (IWA) took up the challenge to address these links at the 5th IWA World Water Congress and Exhibition in Beijing, China (September 2006). Through keynote speeches and workshops it became clear to a broader audience that holistic approaches including both water and sanitation issues will bring sustainable solutions to help reach the health-related Millennium Development Goals (MDGs).

As we are not on track with regard to the sanitation target and the possibility of meeting the water target is expected to decline up until 2015, we need measures in the meantime to help to reduce the disease burden of the unserved. Several case reports from around the world and empirical studies presented at the IWA conference showed the importance of good practice in household drinking water treatment and storage in order to reduce waterborne disease.

Despite actions to raise awareness, such as the foundation of the World Toilet Organisation, the nomination of the World Toilet Day as well as the launch of the Sanitation and Hygiene Week in 2007, to emphasise the importance of sanitation, the overall trend is not encouraging intervention in this field. A promising strategy to improve sanitation at grass root level seems to be the ecological sanitation approach (see the contribution by Christine Werner).

Figure 1: View over the Chinese Great Wall, which was part of the excursion program of the 5th IWA World Water Congress and Exhibition (Source: Th. Kistemann)

Based on this holistic concept, it is possible to provide improved sanitation and to recycle the nutrients from human excreta as fertiliser in a hygienically safe way. Ecological sanitation protects surface waters and neighbourhoods from faecal pollution and offers monetary benefits for the population at the same time.

The promotion of integrated management of water and sanitation issues at the political level is a further challenge. For that reason, global interdisciplinary networking and communication between all stakeholders involved in water, sanitation and health is essential. Here, a Global Water, Sanitation and Health Week or joint water, sanitation and health sessions would facilitate political awareness more than related, but still separate, actions.

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Figure 2: Gala dinner of the 5th IWA World Water Congress and Exhibition in the Great Hall of the People, Beijing, China (Source: S. Herbst)

At a glance:

Annual Conference of AK MedGEO:

From 5 - 7 October 2006 the Medical Geography (AK MedGEO) research group held their annual conference together with the working group on Spatial Statistics of the German Region at the 'Haus Humboldtstein' in Remagen, Germany. Altogether 37 speakers and guests from Germany, France, India and Switzerland discussed the key theme 'Towards a geography of health'. Focusing on spatial aspects regarding human health and well-being, new methodological concepts to detect and explain health-relevant topics and their spatial-temporal dynamics were addressed at the conference. The next annual conference of the AK MedGEO will be held in October 2007 within the framework of the 56. annual congress of the German Association for Geography in Bayreuth (for further information please contact http://www.med-geo.de)

Workshop on Women´s Health in India - United Nations University (UNU-EHS):

On 5th December 2006 the United Nations University - Institute for Environment and Human Security in Bonn, Germany, invited to a public session of the workshop "Business, Ethics and the Right to Health", held from 3 - 5 December 2006. The workshop brought together all parties of the Public Private Partnership (PPP) between Karl Storz, GTZ and UNU-EHS founding and representing the women´s health initiative for improving women´s and girls´ health in India within the framework of the Global Compact. The closure discussion gave an overview of the win-win-win situation of all parties - allowing a transparent communication within the PPP using languages of politics, business and science.

Events on Water, Health and Risk Communication:

February 2007:
1st Meeting of the Parties to the Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Water Courses and International Lakes, 17.01. – 19.01.2007, Geneva, Switzerland
(http://www.euro.who.int/watsan/WaterProtocol/20060711_1)

International Conference on Water Management in the Islamic Countries, 19.02. - 20.02.2007, Tehran, Iran
(http://www.rcuwm.org.ir/?i=BToHMABnATZWYFxt)

March 2007:
Advanced Sanitation, 12.03. - 13.03.2007, Aachen, Germany
(http://www.iwahq.org/templates/ld_templates/layout_633184.aspx?ObjectId=641945)

April 2007:
The European Symposium on Waterborne Pathogens in Surface and Drinking Waters, 19.04. - 20.04.2007, Luxembourg
(http://swap2007.lippmann.lu)

May 2007:
International Conference Towards Sustainable Global Health, 09.05. - 11.05.2007, Bonn, Germany
(http://www.gemini.de/global-health)

June 2007:
5th IWHA Conference Pasts and Futures of Water, 13.06. - 17.06.2007, Tampere, Finland
(http://www.unesco.org/water/water_events/Date/2007/06_June)

July 2007:
XIIth International Symposium in Medical Geography - Changing Geographies of Public Health, 09.07. - 13.07.2007, Bonn, Germany
(http://www.imgs2007.de)

September 2007:
14th International Symposium on Health-Related Water Microbiology, 09.09. - 15.09.2007, Tokyo, Japan
(http://watermicro2007.jp)

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The WHOCC Operational Unit wishes the reader of the "Water and Risk" Newsletter Merry Christmas and a Happy New Year 2007!

From right to left: Dr. Susanne Herbst, Oksana Kraemling, Roger Aertgeerts (Regional Advisor, Water and Sanitation, WHO Regional Office for Europe), Dr. Ina Wienand, Dr. Thomas Kistemann, Yvonne Walz, Corinna Berger, Daphne Fritz