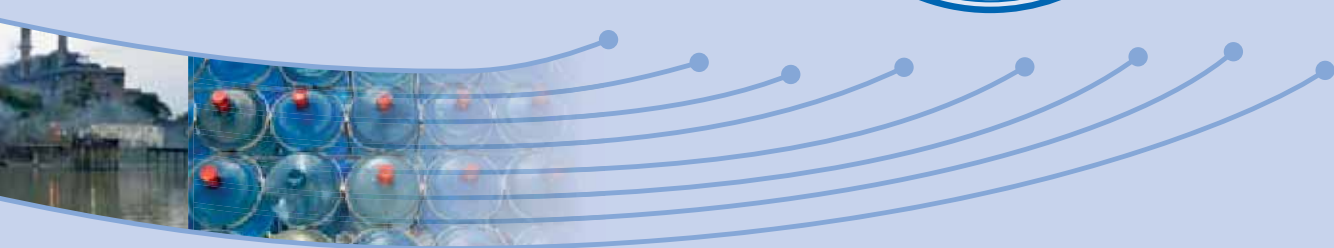


# Overarching Conclusions

## Responding to Global Changes: The Water Quality Challenge – Prevention, Wise Use and Abatement



# WORLD in Stockholm, September 5–11, 2010 WATER WEEK

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## Tackling the Water Quality Challenge

A record number of participants at the 20<sup>th</sup> anniversary, 2010 World Water Week in Stockholm were presented with a hard task at the opening session: they were expected to tackle the manifold aspects of the global water quality challenge and to draw practical future solutions – all in one eventful week.

The results were optimistically progressive, as apparent in this edition of the “World Water Week Overarching Conclusions.” In the first chapter, the Stockholm International Water Institute (SIWI) summarises the thrust of the week’s deliberations leading up to the closing Stockholm Statement addressing the UN MDG Summit. In the second chapter, a team of senior and junior rapporteurs offer their narrative on five thematic streams that they’ve been tasked to cover during the week, whereas the final chapter gives an overview of the astonishing work of prize laureates and award winners.

Yet there are some interweaving lines of thought found in all three chapters. One predominant theme is tackling water within a systems approach. As we observe the rapid increase in resource intensive urbane lifestyles putting a strain on resources, a systems approach that integrates urban and rural areas in a holistic, eco-systems management perspective is needed to deal with water and socio-economic challenges up, along and downstream.

Therefore, wise decisions must be taken where problems persist, which requires better mobilisation of adequate resources to local decision makers in developed as well as in developing nations, and the scaling up of effective implementation models.

This is particularly imperative as we address climate change: a recurring conclusion at the World Water Week is that connecting water and climate change communities minimises the uncertainty clouding our efforts to address forecasted weather variability and future droughts. Bolstering this connection would eventually minimise the negative climatic impacts on water quality, human health and security.

Another theme is the added value of capacitating and empowering young people, particularly young women, via information technology, adequate sanitation facilities and improved water access. These are measures that will not only give them the opportunity to complete their education, but also empower a generation of conscience water managers and improve the well being of their communities.

This report analyses these and many other issues, initiatives and recommendations that were put forward during the Week for the benefit of participants and the broader water and development community.

The World Water Week is the annual focal point for solutions to the growing array of water and development challenges facing the world, and I believe we have successfully managed to tackle many of the issues underlying the 2010 theme “Responding to Global Changes: The Water Quality Challenge – Prevention, Wise Use and Abatement.”

I would like to thank all of you – convening organisations, participants, sponsors and partners alike – for your role in making the 2010 World Water Week in Stockholm a tremendous success. Please mark your calendars for August 21-27, 2011 to join us for the 2011 World Water Week, where we will continue to address these issues and others under the theme “Responding to Global Changes: Water in an Urbanising World.”

Looking forward to seeing you soon,

A handwritten signature in black ink, appearing to read 'Anders Berntell'.

Anders Berntell  
Executive Director  
Stockholm International Water Institute



Photo: Oskar Hemmicksson

## Overarching Conclusions

This section is based on Stockholm International Water Institute's conclusions and what we consider as the key threads that emerged from the week. These overarching conclusions are also based on the summary reports from workshops and seminars and the rapporteur theme reports (see next section of this publication). Our interpretation of issues raised from over 100 substantive sessions are intended to provide meaningful messages for participants who attended the week as well as for stakeholders who did not have that opportunity. The overall aim is to maintain a dialogue between and beyond the intense and fruitful discussions during the World Water Weeks.

### Water quality

The main theme for this year was “The Water Quality Challenge – Prevention, Wise Use and Abatement”. Problems relating to water quality can generally be divided into four categories. The first one concerns biological contaminants such as bacteria and pathogenic organisms. Inadequate handling of human excreta is the main cause of this type of water contamination. The second category relates to pollution that arises from different types of land use and management and includes sediments, nutrients and chemical products for pest control. The third type relates to chemical compounds that are by-products of different kinds of industrial production and are also emitted by the use of these products. The pollutants in this category vary significantly and include both organic and inorganic compounds and have a high degree of in-

dustrial processing in common. The fourth category contains what is often referred to as emerging pollutants and include pharmaceuticals, xenobiotics and endocrine disruptors. These substances are biologically highly active and can have significant effects on humans and on the environment even at low doses.

Historically, water pollution has been seen as an unavoidable cost in the initial stages of socio-economic development. A general thought figure has been that; by allowing some degree of pollution it is possible to achieve sufficient economic growth to be able to clean up the pollution that the growth caused, at a later stage, with a margin that would allow for increased material wellbeing. While relationships of this kind have been demonstrated, it is not clear that it was the activities that generated pollution that provided the growth, nor is it clear that the polluted water courses have been restored to a similar stage as before. What is clear, however, is that polluted water does not automatically get cleaned up by economic growth. Pollution of both surface and groundwater often undermine current and future economic activities, besides health and other adverse impacts. On top of these concerns comes the fact that increased climate variability and the associated droughts and floods will further impact water quality. Floods tend to flush out high amounts of pollutants while droughts reduce the amount of water that can dilute and disperse contamination. To restore the quality of a water body requires significant political, social, entrepreneurial and technical skill as well as will.

## Water borne diseases

The main health problem confronting the world today comes from exposure to organisms that cause water borne diseases. Discussions and exchange of experiences on increasing access to sanitation and drinking water of good quality constantly feature at the World Water Week. However, the nature of the deliberations is changing. Great efforts have been made to provide decision makers with more targeted data and information. Two main messages are emerging. The first is that there are enormous cost implications in terms of human suffering and lost opportunities from not providing people with access to adequate sanitation and improved drinking water. The second is that the water world has the knowledge and the skills to make a great difference. By applying the current knowledge and experience, one fifth of all child deaths, equalling more than 2.2 million per year, could be prevented. Apart from welfare gains that are hard to quantify, the economic benefits of savings in health care and time, together with increases in productive capacity that can accrue from investments in basic drinking water and sanitation are between three and 34 times higher than the costs. Investing in drinking-water quality once basic access to drinking water has been established can lead to economic benefits of between 5 to 60 times the costs. The economic impacts of poor sanitation have been estimated to cost e.g. Cambodia 7.2 per cent of its GDP. Really, no country and no Minister of Finance can afford to ignore these concrete, tangible and profound human facts. In addition to being a human right and a moral obligation, universal access to water and sanitation makes absolute economic sense.

The next step for the World Water Week discussions on this topic is therefore to unpack the discussions relating to the lack of political will and finding additional ways of channelling these positive messages to global, national and local decision makers. There is also an opportunity to engage professionals from spheres such as political science and marketing in this debate to complement the high level of knowledge and skills within the water and sanitation community.

## Land based pollution

In addition to providing us with food, fibre, and fuel, agriculture and forestry also have vast impacts on water quality and water quantity. The main causes for concern with regards to the effects of land based activities on water quality arise from; sediment-borne contaminants from erosion and siltation; nutrient loads of chemical fertilisers, manure, waste water outflow, and septic tank leakage; pesticides; and salts from a range of human activities.

The discussions during the 2010 World Water Week evolved around concrete measures that could be taken to reduce water pollution emanating from land based activities including steps to secure implementation and social acceptance. The need to apply a systems approach to the challenges of agricultural pollution was repeatedly highlighted during the Week.

Reduction in pollution by non-agricultural polluters has been more rapid than for agriculture, especially with regard to nutrients. There has actually been an increase in point pollution from agriculture linked to the intensification, especially of livestock farming. However, there is also a greater public



Photo: Thomas Henrikson/SIWI

The High Level panel on water quality was moderated by Dr. Margaret Catley-Carlson, board member, UNSGAB. The participants from left to right: Mr. Ravi Singh, CEO and Secretary General, WWF-India; Hon. Jorge Patrone, Vice-Minister of Housing, Territorial Development and Environment of Uruguay; Dr. Rita Colwell, Stockholm Water Prize 2010 Laureate; Mr. José Lopez, Executive Vice President Operations, Nestlé; Hon. Charity Kaluki Ngilu, Minister of Water and Irrigation, Kenya and Mr. Björn Stigson, President, World Business Council for Sustainable Development.



Photo: Björn Cüterstam

awareness of the damage to aquatic ecosystems from agricultural practices and a growing concern related to groundwater, coastal zone and marine pollution, especially leaching of nutrients and pesticides. In addition, there is uncertainty over the extent and severity of emerging pollutants from agriculture, e.g. veterinary products. There is a clear link between the amount and intensity of agriculture and the overall pressure on water quality. In half of the OECD countries, nutrient and pesticide levels in surface and groundwater exceed national drinking water standards.

It is important to identify opportunities and tools to reverse prevailing trends of water quality degradation and the role played by agriculture. The growing demand for agricultural products coupled with weak institutional and policy frameworks, frequent market failures and an extra layer of uncertainty regarding changes in our climate, point towards increasing pollution from agriculture. At the same time, improving farming practices, increasing public awareness and pressure, and changing subsidy regimes may lead to a reversal of the trend of agricultural water pollution.

The abatement of pollution from land based sources in general is a highly complex task demanding design and implementation of harmonised policies with a mix of solutions and costly monitoring due to the variation across space and time. The significant time lags also make it difficult to link policy actions to responses. There are often political, social and equity considerations that can influence policy choices and mixes. In many cases it is difficult to construct a robust management system that is adapted to the financial, technical and social capacities of local farmers, especially in developing countries. In general, increasing stakeholder involvement is a key factor in minimising land use based water pollution.

There are several options that can be taken to reduce land based water pollution. Currently, there is no consensus on what measures are best suited to different circumstances, but enough is known to start piloting the approaches at significant scales. These pilot efforts have to be structured in a manner that allows for systematic monitoring, evaluation and if promising, up-scaling and replication.

#### **Production and consumption of complex chemicals**

The production and use of manufactured chemicals are increasing rapidly. A large part of these chemicals are ending up in water all along the chain from raw materials, processing, distribution, use and disposal. These chemicals are providing the global population with enormous benefits, while at the same time causing us increasing challenges.

During the World Water Week, discussions dealt with the different ways that these chemicals find their way into water recipients. The emissions to water from industrial production via point sources has received a lot of attention in the past and in many cases this has led to significant reductions in both water use and water contamination. It seems that the focus is shifting towards the diffuse pollution that arises from the use and the gradual erosion of these products. Several presentations dealt with the increasing array of contaminants in urban storm water. Traffic, buildings and land use activities contribute with significant amounts of sediments, heavy metals and inorganic as well as organic contaminants. Several examples were given of successful measures to reduce this type of pollution including: phasing out lead from gasoline, reducing copper emissions from brake pads, banning lead weights for wheel balancing,

protecting coatings of metal roofs and increasing the public awareness regarding the use of cosmetic pesticides, recycling, and cleaning up after pets. Several of these substances and chemicals are finding their way in to our ecosystems through various pathways including our waste water treatment plants. The textiles, electronic equipment, personal care products, building materials and household chemicals we use contain compounds such as: nonylphenol, triclosan, brominated flame retardants, phthalates, polyfluorinated compounds, metals, organo-phosphates and polyaromatic hydrocarbons. The keys to reducing the releases of these chemicals to nature lay in finding substitutes, but increasingly also in educating the end-users in proper handling and disposal of these products.

The different roles of governments, private sector, science and civil society in the quest for reducing water pollution was a topic that ran through the workshops, seminars and side events. A description of governments as the regulators, private sector as the main doers and science and civil society as the providers of trust and constructive challenges, resonated well with a majority of the participants. The need to develop mechanisms to ensure transparency and accountability was also noted as a key factor to facilitate social acceptance and compliance to regulation and to avoid capture of policy processes by narrow interests.

The business community attending the week presented their efforts towards contributing to the solutions to the water challenges and in many cases opened up to constructive input from governments, science and civil society in assisting them in finding better metrics, educating consumers and reducing their water footprints.

### Emerging pollutants

A particularly challenging type of compounds addressed during the week was the occurrence, fate and accumulation of emerging pollutants in water and wastewater, and their impact on human health and ecosystems. The development and production of new chemical compounds is so fast that yesterday's leading edge is today's household item. Several of the compounds listed under the previous heading could also fit under this, as little is known of their impacts on us and on our surroundings. They comprise a wide variety of complex chemicals that can cause severe biotic damage at low concentrations, threatening the functions of life. They include both industrial additives, surfactants, pesticides, "wonder drugs", pharmaceuticals and endocrine disruptors. These pollutants appear both in effluents from treatment plants, in drainage from agricultural land and settlements, and in leakages from septic tanks as well as landfills with their piles of corroding consumer products. Some pollutants are resistant to decay and do not vanish even if banned. Others split during degradation into even more dangerous substances.

Early omens of effects have been reported since the 1950's in terms of health disturbances of living organisms in air, on land

and in water. Concern has been growing with time over the increasing effects also on humans in terms of organ disorders, fertility and neurological disturbances, even suggesting trans-generational effects.

Numerous cases of appearance in rivers, in raw water sources, in wastewater and sewer outflows were reported during the discussions, including the fate of emerging pollutants in a case of large scale wastewater reuse. Not only the widespread use of human drugs but also of veterinary drugs caused increasing concern. The concern deepens when realising that medicine use is increasing in a world with growing populations and growing cohorts of elderly people. It was suggested that known endocrine disruptors probably only represent the top of an iceberg. Discussions highlighted both biological effects on living species and the problems met in wastewater treatment where pharmaceuticals escape removal unless adding extremely costly steps for their elimination. The poor understanding of the biological and chemical degradation in the natural environment was seen as highly disturbing.

One message emerging from the discussions was the strong need for research to generate better understanding of environmental degradation and transformation products. Long term effects on humans and other living creatures have to be analysed and proper strategies for waste disposal be developed. When it comes to pharmaceuticals, it was suggested that prescription lists



Photo: Dima V/SXC

of less damaging pharmaceuticals might be an alternative approach to introduction of complex concentration thresholds.

It was concluded that emerging pollutants are raising extreme technical challenges. One issue of special relevance for the water community is the implications for increased waste water reuse. Another relates to the growing hope currently paid to productive sanitation for reuse of nutrients as a win-win solution notably in developing countries with poor soil fertility, and the potential advantages or disadvantages of such practise. The implications of expanding reuse of urine have therefore to be analysed in view of its content of emerging pollutants and the fact that some may be absorbed by plants when irrigating. It was however suggested that putting urine in the soil is a better solution than conventional disposal into water systems, generating problems for aquatic systems especially fish.

In summary, emerging pollutants are already permeating the world and threatening functions of life, including disruptions of fertility, both male and female in humans as well as in other living organisms. Research is essential to develop the knowledge needed as a base for sound policy development. The proposed remedies ranged from banning to source separation and regulations including threshold values. It is important that the effects of all current and future consequences arising from

the use of any new chemicals are carefully taken into account. As always it is paramount that one use of water does not render other uses and reuse impossible.

### Closing the loops

The general prescription against increasing water quality deterioration is a paradigm shift in the way we use water and other resources. If we continue to use water as a medium for solving and transporting unwanted substances over long distances, be it human waste or industrial by-products, it will be increasingly difficult to maintain human and ecosystem health. By seeing waste as a resource, provided it is put in the right place, in right quantities and at the right time, several of the challenges listed above could be solved. To change the mindset and finding practical recycling solutions should, however, not be underestimated. One key to increasing the prospects for recycling is source separation. Currently most waste is mixed and placed in the same waste bin or sewer. With regards to wastewater there are several aspects that need consideration to allow for increased recycling: there are a range of sanitation options, different treatment levels for different types of reuse, the role of agriculture in the wastewater treatment cycle, policy and institutional frameworks that support reuse, suitable economic incentives and the ownership of wastewater. The most common use of wastewater is for irrigation. But the majority of this use is unregulated. Global estimates of the extent of wastewater irrigation range from 4 to 20 million ha. Many of the 200 million farmers who specialise in market gardening rely on raw or diluted wastewater. Practices range from the use of polluted surface water, to raw wastewater, to the piped distribution of secondary or tertiary treated wastewater. Use of wastewater for irrigation can be a way of maximising water use efficiency, as well as closing the water and nutrient loops to sustain and promote food production. When wastewater irrigation is well regulated, the agricultural sector provides the urban sector with a valuable environmental service.

There were several practical examples during this year's deliberations of how wastewater treatment plants are becoming "green factories". By collecting food waste, waste water, fats and greases, and other organic wastes, treatment plants can be net producers of electricity, biofuel, fertiliser, and water for irrigation, industry and public consumption.

As the organisers of the World Water Week, SIWI is delighted to see how the tone in the discussions between stakeholders from government, business, science and civil society is becoming more and more constructive. A vast majority of the deliberations were held in an open, frank and respectful spirit. This does not mean that there always was a general agreement on the right solutions, but rather that there was an attentive dialogue on the pros and cons of the proposed solutions from the different perspectives.



Photo: Jupiterimages





# Managing Water Across Borders

**Lead Rapporteurs: Dr. Marius Claassen and Mr. David Osborne**

**Junior Rapporteurs: Ms. Nina Weitz, Ms. Junna Maltseva, Ms. Karis McLaughlin and Ms. Hanna Larsson**

## Key Recommendations

- Governments, industry and civil society should collaborate to:
  - address the interdependence of water quality and water quantity,
  - strengthen cross-border institutional capacity and actively support comprehensive, ongoing and adaptive cross-border governance mechanisms,
  - promote collaboration focused on turning water quality problems into opportunities – e.g. trade in wastewater products,
  - link freshwater and coastal water quality objectives.
- Increased investment must be given to understanding the nature and extent of cross-border water quality issues, including the impact of population growth, land-use change, and climate change on water quality.
- A bottom-up approach, where stakeholders are involved in framing problems and options, must complement the top-down approach.

## Context – setting the scene

Over the last 20 years, the World Water Week has become a meeting place where pressing water issues are discussed and solutions are formulated. The realisation that these complex

issues require solutions that transcend borders culminated in the special focus on transboundary waters in 2009. The focus on the water quality challenge during the 2010 World Water Week highlighted the interconnectedness of water issues and confirmed the need for more effective management of water across borders.

Water quality is an important, but often forgotten, aspect of managing water across borders. It is as important as water quantity, specifically because water pollution decreases the availability of water for human consumption, agriculture and industrial development, while threatening freshwater, coastal and marine ecosystems and the associated ecosystem services which we depend on. Water quality is a reflection of land use, but there is often a difference in space and time between the source of the pollution and its effects. This highlights the importance of communication across both jurisdictional and sectoral borders in managing the common resource, since the benefits and costs from actions may only be experienced by people elsewhere or by the next generations. Unilateral or segregated efforts to address water quality problems are therefore be inadequate.

Management of water across borders must be adaptive, as the rules of the game are constantly changing with a growing population, economic development and climate change. At

the same time as the demand for food, feed, fibres and biofuels increase, there is a growing concern for the health of ecosystems and a growing demand for recreational use of water. There has not been enough progress on managing aquifers across borders, particularly the linkages between groundwater and surface water. Managing water across borders is not only an issue of sharing water resources, the benefits from water, and a responsibility for protecting water quality across borders, but also about the understanding the implications and opportunities of virtual water. The water footprint of products in global or regional trade, both concerning water quantity and water quality, will affect access to water of good quality and healthy ecosystems. Changes in the global political economy thus have implications for the distribution of water quality problems. Global trade patterns are causing shifts in production, which can lead to pollution and illegal dumping of waste in regions where regulation and enforcement are weak.

One of the important issues in water policy and decision-making is to balance environmental objectives with social and economic ones. A holistic approach should consider benefits to all parties and find solutions that will ensure stakeholder buy-in to ensure successful implementation. Such participation is promoted when technologies are easy to understand. Differences in investments and funding from various sources also represent borders, but participants of the World Water Week acknowledged that where money was available, the political will is often missing. More coordination and involvement is therefore needed between countries, within countries, and between different sectors.

### **Progress made to date**

Much knowledge has been accumulated over the years on how to manage water across borders. It is now time for action and time to stop repeating messages we already know. The steps for action are however not as clear as the theory. The value of small steps should not be underrated and we should pay attention to opportunities for cooperation. Technical and infrastructural cooperation has been highlighted as a possible entry point. There should be a focus on regional integration because the benefits of cooperation in enhancing water quality are far-reaching. Shared water resources do not necessarily lead to conflicts. In the case of the Lake Victoria basin in Africa, shared water resources also drive regional cooperation. The EU Water Framework Directive and the Baltic Sea Action Plan are two examples from Europe on international agreements that state baselines for water quality in the member countries and in a shared sea, respectively. The objectives are focused on achieving a good ecological status in freshwater and marine ecosystems and actions are identified to enable individual countries to move forward to achieve these goals.

Securing sufficient water knowledge is a crucial prerequisite for addressing water quality issues. There is a need to advance

monitoring and data collection efforts with the aim of creating comprehensive regional and global assessments. Building databases that are acceptable to riparian countries may be a challenging task, but there is a demand for them and it is an opportunity for action. There has been progress in the development of indicators for assessing water quality within an IWRM framework. This includes the assessment and results tracking of transboundary water systems, with indicators relating to water quantity, water quality and ecosystem assets. Within the field of transboundary waters, a call for 'effective' cooperation, river basin organisations, or water treaties are commonplace, without clarification of what is actually meant. We need a more systematic and rigorous analysis of what effective governance should look like and whether this is being achieved. There are new efforts to establish indicators for assessing the quality of governance. Their applicability is still under discussion, but it could be a first step in addressing water quality through identifying areas where governance needs to be improved.

There has been significant progress in recent decades in the field of international water law. The life and well-being of people and the natural environment are inextricably linked. This notion is central to the call for a "greening" of water law which sees environmental considerations integrated into water law, policy and management. Mechanisms applicable at the international level include equitable and reasonable utilisation, no significant harm, environmental impact assessment, pollution prevention and abatement, environmental flows, and protection of ecosystems. The UN Resolution on the Law of Transboundary Aquifers placed a special emphasis on vital human needs when realising the principle of equitable and reasonable utilisation, providing safe and good quality water for all strata of the society.

### **Prospects and opportunities for further progress**

A shared understanding of benefits is acknowledged as key for fostering cooperation. Benefits are often not made visible and the consideration of benefits is often limited to the water sector even though benefits go beyond the basin. Further progress can be made by "getting out of the water box" and adopting a cross-sectoral approach. Complimentary agendas of countries and sectors should be identified and built upon. Investments in water quality infrastructure is one example where cooperation can translate to mutual benefit. In looking for entry points for cooperation in politically contentious basins, it can be helpful to find common interests and build confidence at a technical level.

A combination of top-down and bottom-up approaches is important. Top-down processes are dependent on political will and skill. This is highlighted by the increased public pressure to decrease the economic, social and environmental costs of not acting on water quality issues. There is an increased awareness at political level that we need to agree on solutions to common



Water quality is an often forgotten aspect of managing water across borders, but just as important as water quantity remind lead rapporteurs Dr. Marius Claassen and Mr. David Osborne.

problems. From the bottom-up perspective, we need to communicate and share experiences, so that we can learn from these cases and adapt methods to local conditions. Improvements in knowledge-sharing and capacity building can reduce power asymmetries and enable knowledge-based decisions.

There is an expressed need to bridge the gap between conservation and development. This requires a balance in viewing wetlands, freshwater and coastal ecosystems as pristine systems and in valuing their worth as providers of services and benefits. In managing water across borders, maintaining the integrity of these systems to sustain the provision of services can be an opportunity for collaboration and cooperation between countries.

Equitable, effective and sustainable water resources management requires inclusive negotiation, which means that constructive engagement between multiple stakeholders is critical. If decisions made over water are not recognised as legitimate, non-compliance can lead to pollution and degradation of the resources. The need for top-down guidance should be complemented by local solutions and action. Affected communities should have the opportunity to increase participation and ensure the selection of technologies that suits them best. This should not be delayed by the finalisation of “grand plans” or decision from above. Local problems can also be translated to local business opportunities.

Whilst a priority water quality issue is safe drinking water, this is not the only issue. Water quality is integral to many services provided by the global freshwater system. There has been much attention to water quality guidelines for drinking water, but there is not yet agreement on an approach to water quality guidelines for freshwater ecosystems.

### **Challenges and obstacles for progress**

Many emerging pollutants (including pharmaceuticals, industrial additives and pesticides) have unknown effects, and are difficult to detect. The number of new chemicals in products which can end up as pollutants in water will continue to increase.

The lack of institutional strength, trust and political will are key obstacles to progress. Improving these is a prerequisite for cooperation but they are slow to develop and easily destroyed. Much effort is needed to improving governance since stable states enable stable cooperation, which enables water quality problems to be addressed effectively. The uncertain nature of climate variability and change complicates cooperation across borders while increasing the demand for it. There is sometimes too much reliance on waiting for international negotiations and agreements to provide guidance, which may slow down progress on the ground. The short-term interests of stakeholders and politicians can be obstacles for long-term thinking about how to best manage common resources.



Photo: Jakob Granit, SIWI

Corruption linked to water pollution is another challenge due to poor governance and lack of transparency, accountability, and regulatory frameworks at national and transnational levels. The lack of appropriate legislation as well as aligning national and basin-level policies have also been raised as obstacles that reduce the progress on controlling water quality across borders. Implementation and enforcement of both international law and national policies is critical, with capacity being a major challenge, particularly in less developed countries.

Many social, religious and economic issues as well as local habits, education and technologies should be considered when introducing measures of water management. The implementation of IWRM can be hampered by the need for institutional development, weak governance, lack of money, lack of participation and the need for increasing investment security.

### Conclusions

It is time to act. Cooperation is not an all-or-nothing, and therefore small steps should not be underrated. It is about finding the right level of effort acceptable to all. Cooperation is a process and not an end-point itself; it provides the basis for achieving joint goals. It is important to go beyond the water box to take advantage of the potential benefits of cooperation through a holistic, long-term and multi-disciplinary approach. Inter-sectoral cooperation is needed to deal with the complex problems related to water. Much can be done locally and nationally, but we also need cooperation and a global approach to deal with the global water quality challenge. Global agreements and top-down legal frameworks may be necessary but are not sufficient for effective management. For effective management of water across borders, visions and plans need to be connected to and harmonised at various levels and across sectors.

Water resource management and development can be improved by collecting and sharing data through regional databases. It is important to involve stakeholders in framing the problem, modelling, and decision making to benefit from local knowledge and to create trust. Other dimensions of managing water across borders include bringing public and private sectors together towards effective policies and action plans, linking experts with decision-makers to promote science-policy dialogue, and encouraging water professionals to work with society and business.

The consensus of the 2010 World Water Week was that we have many good action plans but it is now time to move from the discussion to concrete actions and implementation of these plans.

This can be promoted by more communication and transparency to improve information flow and involvement towards more effective action. There is a need to increase people's awareness and knowledge, but capacity development should also result in practical solutions.



## Coping with Climate Change

**Lead Rapporteurs: Dr. John H. Matthews and Mr. Alex Simalabwi**

**Junior Rapporteurs: Mr. José M. Delgado, Ms. Anne Gädeke, Ms. Rebecka Segerström and Ms. Sara Tynneron**

Recent coping with climate change rapporteur reports have noted transitions over the past three years on how climate change issues are discussed at World Water Week. As recently as 2008, climate change was a nebulous term for most lectures and attendees. Climate change mitigation (i.e., reducing the concentration of greenhouse gas emissions in the atmosphere through shifts to “green” energy sources like hydropower or through rapid carbon-uptake mechanisms) and climate change adaptation (i.e., adjusting societies and ecosystems to existing and emerging climate change impacts) were often conflated and confused, without clear distinctions. Climate change policy was rarely mentioned.

By 2009, the distinction between adaptation and mitigation was widely recognised, and most speakers and audience members had identified climate change adaptation as a central problem for water resources management and policy, with climate change mitigation withdrawing to narrower topics such as hydropower and biofuels. Additional distinctions were made between on-the-ground adaptation action with water managers and the importance of good global-level policy and finance to support practical action.

By 2010, the emphasis on climate change adaptation had increased significantly in sophistication. A common language and vocabulary had emerged around climate change in the water

community, particularly adaptation. Policy discussions spanned multiple levels – global, international, regional, national, and local – while the importance of effective governance in implementing adaptation was recognised as a distinct concern. Practical action focused on tool development, linking practice to policies, and the development of “flexible” or “adaptive” institutions.

Overall, the discussions in 2010 focused on four general themes:

- the role of global climate change negotiations in effective water management;
- connecting the climate change and water management “communities,”
- practical mechanisms for dealing with uncertainty in projecting future impacts, and
- how the process of adjusting to new hydrological conditions interacted with the policy and governance of water management institutions.

### **Communicating the need for effective water management to global policy audiences**

References to global climate change policy at World Water Week focused on the UN Framework Convention on Climate Change (UNFCCC) negotiations process. Perhaps the most



Photo: Mikael Ullén/SWI

Lead rapporteurs Dr. John H. Matthews and Mr. Alex Simalabwi discover that effective water management is no longer viewed as separate from climate change adaptation.

widely discussed climate change topic in 2010 relative to 2009 was the failure of water issues to gain traction at the UNFCCC meeting in Copenhagen last December (referred to as COP15). Indeed, last year's climate change sessions focused strongly on messaging in advance of COP15, with the clearest expression of this sentiment in the "Stockholm Message to Copenhagen," the official 2009 World Water Week policy statement. Hopes ran high that policymakers in Denmark would see effective, sustainable water management as a critical component to adjusting to climate change impacts. Since December 2009, however, COP15 has been judged by many as a failure because no comprehensive greenhouse gas emissions agreement was achieved (though many who have been long involved in these negotiations warned that an agreement on climate mitigation or adaptation will never be simple or fast to achieve and the most important failures from Copenhagen came from overly high expectations).

A significant minority in the water community feel that COP15 was an even greater failure because "our" 2009 messages, the fruit of extensive internal debate, were given little or no hearing in Copenhagen and seemingly had no impact on the official negotiations. Perhaps in reaction, others felt that the UNFCCC was irrelevant to practical adaptation action in water management. Hallways and meeting rooms in Stockholm in 2010 were filled with questions such as: Why did the water community not have a greater impact in COP15? Is high-level climate change policy relevant to climate-smart water management? Should the water sector continue to engage in global-level climate change discourse and what should be the strategy for future global policy dialogs? Despite often heated debate, no clear consensus was arrived at on these topics.

### Connecting the climate change and water communities

A related but distinct theme to UNFCCC engagement was the strong sense that the climate change and water "communities" are seen as both separate and not effectively communicating with one another. The water community consists of people and organisations directly involved in water management policy and practice. The climate change community consists of individuals and organisations involved in national and international climate change policy (often emphasising climate change mitigation), development banks and aid agencies that fund work explicitly referenced as "climate change" projects, and the small but growing number of groups engaged in climate change adaptation. For the most part, the water community views the climate change community as more powerful and dominant and either unaware or dismissive of the water community. The Weeks discussions focused on how to bridge the perceived gap between these groups.

The climate change community tends to view "water" as a narrow set of issues, with the energy, forest carbon, health and sanitation, manufacturing, and agriculture sectors being seen as distinct from the "water sector." Water in this view is often limited to surface water resources in lakes and rivers. The water community, however, sees water issues as spanning a wide range of sectors, with the implication that effective water management should be viewed more holistically by emphasising a wide range of hydrological processes (e.g., precipitation, tropical storms, soil moisture, groundwater, surface water). Water infrastructure can either facilitate or hamper effective adaptation, and water is often embedded in goods and services (virtual water). From this perspective, water management is the most important tool to enable human adaptation to emerging climate change impacts.

World Water Week discussions focused largely on strategising methods to bridge perceived gaps. For instance, the “water-energy nexus” was recognised as a special area of conflict. Efforts to promote hydropower as a low-carbon energy source may result in significant limits in the adaptive responses for ecosystems or communities. The promotion of biofuels such as sugarcane or corn ethanol often ignores the large-scale consumption of water required to grow and refine these crops, especially in water-scarce regions. The transport of water over long distances or the increasing use of desalinisation as means of adapting human communities consumes large quantities of energy (often from carbon-intensive sources). Forest carbon projects often assume that water resources will remain relatively constant, especially in large tropical forest reserves.

Moreover, the climate change community tends to emphasise the need for “additionality” when financing projects that are explicitly designated climate change mitigation or adaptation projects, while the water community tends to emphasise the need to “mainstream” climate change adaptation practices. Additionality is a term borrowed from high level climate change mitigation policy discussions and has two levels of meaning. For more than 20 years, additionality first distinguished funding related to the responsibility of rich countries to put additional resources needed for environmental protection measures at the disposal of developing countries. Thus, simply relabeling existing “Overseas Development Aid” ODA funding as “adaptation” would not be acceptable under UNFCCC mechanisms. At a sub-national scale, additionality has also come to refer to the need to document that there is a quantifiable difference between

a project that includes a climate change component and one that doesn’t. A storage dam intended to handle 10 per cent more extreme drought/flood events in the future, for instance, would thus show “additionality” costs associated only with the “extra” design and operating expenses for the impacts clearly attributable to climate change. Many in the water community point out, however, that projecting hydrological conditions in the future with confidence – particularly over the long lifetimes of many types of water infrastructure – is very difficult. Moreover, determining how much worse a tropical cyclone is because of climate change, or how much more extreme of a drought or flood, is not often seen as a simple or clear problem by climate scientists.

A consensus seems to be emerging within the water community that developing new types of risk-based planning and operations techniques rather than simply infrastructure designs is the most effective means of implementing climate change adaptation. Such an approach emphasises the need to mainstream adaptation throughout water management institutions, often through capacity building, which suggests that additionality may be difficult or impossible to document at the project level. The conflict between the need for additionality and the practical desire for mainstreaming, especially in the funding of water infrastructure, is likely to be an increasing source of friction.

Much internal criticism of the water community was raised as well. Among individuals engaged with the UNFCCC processes and national-level climate change policy, there were charges that the water community has made little cohesive effort to educate itself about the policy structures and institutions and debates



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that define the climate change community and to translate “water issues” into “climate change issues.” The forestry and agriculture communities were described as sectors that have effectively mobilised themselves within the UNFCCC and received recognition for their special challenges. However, these communities are reaping the benefits of five, ten, or more years of coherent engagement with the UNFCCC, while the water community – as suggested above – has only recently begun to coalesce around a clear set of issues, much less create institutional mechanisms to work within the UNFCCC framework.

### **Coping with uncertainty about future water resources**

The hydrological cycle is very sensitive to shifts in climate, so historically good water resource management has always included an element of managing uncertainty. However, projections of future climate in global circulation models are notoriously inconsistent for precipitation, evapotranspiration, and runoff patterns, especially as the spatial scale of interest narrows or the operational lifetime of a piece of infrastructure increases. Thus, climate change increases the level of uncertainty and makes effective management much more difficult. Many speakers provided examples of climate-infrastructure mismatches in particular regions. Should large storage dams be designed to compensate for both declining flows and extreme flooding? How should policymakers compensate for declining hydropower output if erratic seasonal snowpack makes dry-season flows irregular? Should expensive high-efficiency irrigation systems be deployed in regions where no competition for water resources now occurs?

Much effort is now going into “downscaling” climate models for the sub-basin spatial scales of most infrastructure projects. Many speakers pointed out that the results of downscaling have been used uncritically for management decisions. The gap between what climate change scientists know about the degree of confidence that can be sustained by their models and how

policymakers, planners, managers, and funders apply quantitative versions of downscaled output remains large. Ironically, attempts to explicitly adapt infrastructure through a vision of the future defined by downscaling may actually increase the potential for maladaptation, loss of infrastructure function, and significant social, ecological, and economic disruptions.

The main alternative to downscaling comes from risk-based approaches, which tend to be qualitative or semi-qualitative and include a “gaming” or scenario development component to span multiple potential futures. Integrating risk-based approaches within infrastructure design and operations approaches presents a major challenge for engineers and planners, however, and several sessions described new tools and approaches to explicitly incorporate these methodologies.

Two general approaches included focusing on adapting to climate variability (the frequency and severity of extreme events) and on building resilience to resist passing tipping points (also known as thresholds). Adapting to variability acknowledges the widespread observation that extreme events are, in many regions, becoming even more extreme as the climate continues to change. For infrastructure, this often means developing design tolerances that can span a wider range of hydrological conditions, operational flexibility, short- and medium-term weather forecasting, and redundancy of function.

Building resilience is widely accepted as a complementary process to adapting to variability. Whereas variability assumes that “mean” climate remains relatively constant over time, building resilience assumes that a particular eco-hydrological system can exist in several distinct states, and that the transitions between these different states are often non-linear and sudden tipping points. Building resilience is thus a process of trying to stop, defer, or reverse these transitions, especially in so-called “linked social-ecological systems,” where humans and climate change may work together to surpass tipping points. Uncertainty



in the context of resilience often centres on the triggers for tipping points or the most effective means of building resistance to negative states. Unfortunately, while the terms resilience, tipping point, vulnerability, and threshold were widely used throughout World Water Week, they were often inconsistently defined, particularly across economic, political, ecological, and hydrological spheres. “Building resilience” in particular runs the risk of becoming a meaningless truism.

Finally, several speakers noted a growing interest in climate risk insurance as one tool to confront uncertainty for the agricultural sector and the rural poor in the developing world.

### **Redefining climate adaptation as a governance and policy challenge**

As recently as 2009 at World Water Week, climate adaptation was defined as a largely a technical problem for engineers, climate modelers, and scientists. The “solutions” to climate change derived from expert adaptation personnel. One of the remarkable innovations for the 2010 Week was the consensus among speakers and audiences that climate change adaptation – at least in water management – is largely a holistic, cross-cutting challenge for institutions as a whole rather than for few highly trained or specialised individuals. Effective water management is no longer viewed as separate from climate change adaptation. Many speakers noted that more dynamic and flexible institutions are required to respond to shifting hydrological conditions. Particularly at the local level, empowering institutions to respond to local conditions and across sectors is increasingly critical.

Two aspects of this theme arose repeatedly. Building the capacity of operational staff to understand how climate change alters business as usual practices – to think about managing shifting water resources in new ways – was seen as a positive and liberating means of effecting change. In practical terms, building capacity often referred to creating new ways for separate organisational silos to interact. For instance, many governments tend to create “climate change” departments or agencies that are distinct and not integrated with water management ministries. As suggested in the water vs. climate change communities discussion above, such distinctions tend to create bureaucratic conflicts and overlaps that are often artificial. Using staff expertise in climate change to support water management staff is probably the most useful way of build adaptation capacity in this case.

The second commonly heard aspect of this theme was the aforementioned conflict between additionality and mainstreaming. The need for high-level staff to provide a line-item accounting of any “new” actions associated with climate change adaptation is understandable, especially in the context of climate finance. However, these distinctions are often an obstacle to practical adaptation action. Indeed, they are often the justification for creating distinct climate change and water management departments and perpetuating silos and ineffective coordination.



Photo: Mark Potter/SXC



Photo: Annika Börje

# Balancing Competing Demands

**Lead Rapporteurs: Ms. Susanne Schmidt and Mr. John Metzger**

**Junior Rapporteurs: Mr. Tatsuhiko Sato, Ms. Lara Esser, Mr. Claas Meyer and Ms. Ekaterina Sokolova**

## Recommendations

- Mainstream social, economic and environmental considerations into water resources management to balance demands for better development outcomes, actively combating drivers of pollution.
- Apply and further develop practical approaches and tools to improve water governance, such as performance benchmarking, footprinting, negotiation frameworks and human rights based approaches.
- Apply integrated systems approaches such as RBM, IWRM, whole of water cycle, to integrate quality and quantity concerns and to advance a comprehensive understanding of land use based water pollution and effective responses for abatement and prevention.
- Reflect the economic value of water and related resources in environmental and development policies; gather more evidence of benefits derived from innovative approaches such as recycling/reuse and payments for environmental services to encourage decision-makers to adopt equitable and sustainable water management practices.
- Better understand the competing needs for water of different water quality and implement reuse and recycling based on differentiated needs, scaling up innovative concepts; improve communication to encourage wastewater reuse and overcome negative perception barriers.

- Close the communication gap and integrate groundwater in surface water networks, and promote conjunctive use. As water is now commonly managed by River Basin Organizations, target RBOs for groundwater management capacity development.

## Context

Untreated sewage, agricultural leachates and industrial effluents containing a growing array of xenobiotic synthetic chemicals ever increasingly pollute water resources and threaten human and ecosystem health. The availability and quality of water resources is closely linked. The more we pollute, the harder it is to provide clean water; overabstraction and climate change induced water scarcity exacerbate pollution problems.

Economic valuation of water resources use and pollution impacts remains inadequate and challenging, as does financing the protection and sustainable management of water resources and the provision of water supply and sanitation. With the expansion and intensification of pollution under business as usual the costs of clean water become progressively unaffordable.

As the different groups in society compete for water often the benefits and costs do not accrue to the same groups. Increasing water scarcity and deteriorating quality, and their negative impact on sustainable development globally, risk deepening inequalities as the rich are able to meet their demands often at

the expense of or by ignoring the poor. Conventional fragmented sectoral approaches are clearly not working.

Population increase, urbanisation, economic development and agglomeration of economic activity, consumption patterns, and public concern about greater equity and about the planet's sustainability are among the primary drivers in reshaping management strategies for securing water quantity and quality and for balancing sectoral demands, both in developing and developed countries.

### Systems approach needed

The World Water Week's 20 year retrospective was a reminder of progress made in conceptualising and understanding the competing demands on water resources and of advances in technical, social, and economic approaches and tools for better governance and management. But while thinking has advanced, progress on the ground remains incremental and slow. Conceptually, it has been clear for some time that a systems approach is necessary, and strides have been made, for instance with River Basin and Integrated Water Resources Management, but practical application is lagging behind the growing challenges of sustainable water use, particularly when it comes to understanding and dealing with economic signals and market forces that drive behaviour and decision-making.

Successful experience with systems approaches exist and need to be scaled up. The Moreton Bay Waterways and Catchments Partnership (MBWCP), S.E. Queensland, Australia, is one exam-

ple of an integrated catchment and whole-of-water cycle approach to address point and non-point pollution of coastal waters and water supplies. The partnership brought together scientific experts, industries, communities, and local governments to address upstream-downstream demands and concerns between agriculture, urban use, coastal tourism, aquaculture, and ecosystems. An Ecosystem Health Report Card improves accountability and transparency and has attracted wider stakeholder involvement and investments in environmental management.

Approaches similar to the MBWCP are being rolled out in China and India, strengthening local government capacity through partnerships and stakeholder driven implementation plans.

Market-based tools such as payment for watershed services and water quality trading programmes have been growing, but wider implementation requires facilitating policies and improvements in transparency, accounting and impact monitoring. In general, integrated systems-based approaches benefit from the existence of management frameworks, such as the EU Water Framework Directive, to provide an enabling environment.

### Rethinking the waste spiral – new approaches towards greener economies

Reducing pollution must play a key role in the development of practical management frameworks that bring together the economic, social and environmental aspects of water use. To meet growing demands and protect the viability of the very ecosystems that influence water, we have to transform the proc-



Photo: Mikael Ullén/SWI

Better understanding of the competing needs for water of different water quality is key to implement reuse and recycling report Mr. John Metzger and Ms. Susanne Schmidt.

esses and structures by which we turn clean water into dirty water, turning an asset into a liability, and by which competing uses of water impact the ability of different groups to use and benefit from water.

Urban centres in developing countries in particular are caught in a waste spiral that drives inequality and constrains economic development. As Sunita Narain put it: the more water we use the more waste water we generate; the more waste, the more it costs to clean up; the more it costs, the more we cannot pay the full cost; the more we don't pay the full cost of water, the less money there is to invest in waste and sewage treatment; the less we invest in waste and sewage treatment, the more pollution we generate.

We urgently need to rethink water supply and waste management approaches and design systems for water frugality, affordability, reuse and local scales. We have to reinvent economic growth without pollution, shortcut historical pollute-grow-clean up water pollution trends and innovate water technology and management towards a greener economy.

### **Waste not, want not – demand for recycling and reuse is evolving**

Recycling and reuse is increasingly important to meet water demand in the context of water scarcity and for nutrient recovery and recycling, and is seen as an essential climate change adaptation response to reduced water availability. Many innovative projects were highlighted, such as an integrated sanitation and aquaculture enterprise in Ghana which captures the value of human waste and uses the profits from fish sales to finance the sewage treatment works, or a project in Surat, India that reduced groundwater abstraction through reuse to mitigate acute water shortages. The value of water, existing and new technology, infrastructure requirements, and stringent requirements for industrial pre-treatment and environmental regulations are among the main driving forces of reuse, but cost and public health protection remain concerns with non-potable use of water.

Despite the need to reuse water, not only technical, but also perception barriers need to be overcome, in particular with respect to drinking water. Even with better technology, public acceptance of recycled water may not be assured and evolving policy and regulatory contexts bring uncertainties for project management.

### **Groundwater – no longer out of sight, out of mind**

Groundwater is endangered in many parts of the world as a result of over-exploitation and pollution, largely driven by unconstrained urbanisation and continued pressure to increase irrigation use. The lack of or insufficient management of groundwater resources has been attributed to the limited information that exists on aquifer systems and their water storage; the unwillingness or limited capacity of water managers to monitor groundwater abstraction and discharges of contaminants from

economic activities and sanitation systems; the inadequacy of the law in protecting the resource; and a general belief that groundwater is endless because it cannot be seen.

Nonetheless, growing commitment to improve groundwater management is illustrated, for instance in the Africa region, by capacity development through professional courses that are provided by the African Groundwater Network and which are a forum for surface and groundwater specialists to talk, and by the creation of the Lake Chad Basin Commission, which is charged with managing groundwater and has made efforts to adopt the draft UN Articles for use and management of transboundary groundwater.

The management solutions and the information necessary to sustain groundwater as a resource are increasingly available, even in developing countries. Management needs to seek equitable access by all vested interests and address inconsistencies between energy, credit and pricing, and water policies. Prevention of groundwater resources pollution will always be preferable to treatment and remediation. While new technologies for remediation of polluted groundwater are becoming available, they are typically expensive and require long periods for full implementation.

### **Private sector involvement**

Private sector involvement and leadership in efforts to improve management and sustainability of water use is growing, driven by corporate understanding of risks and opportunities associated with water as a resource for business sustainability, and by accountability to shareholders, consumers and producers.

The Better Cotton Initiative (BCI) is an illustrating example of an industry-wide initiative by leading end-user garment retailers such as H&M, IKEA and M&S to reduce the environmental footprint of cotton production, fulfil corporate social responsibility standards, and improve farmer income and local livelihoods. In one collaboration between IKEA and the World Wide Fund for Nature in south Punjab, Pakistan, for example, Better Management Practice (BMP) including better irrigation techniques and pest management are disseminated through farmer participation and capacity building. BMP resulted in 25-75 per cent reduction in pesticide use, 15-30 per cent reduction in irrigation water and 15-30 per cent increase in gross margins of farmers between 2005 and 2009, compared to non-BMP farmers. The challenge remains how to scale out and benefit groups outside the interests of businesses.

### **Footprinting**

Water footprinting is not only a communication and awareness raising tool to inform customers of the water impacts of products, but is increasingly seen also as a powerful tool to inform water allocation strategies and spatial and land-use planning. With the recent advances in underlying methods and data, the

tool has the potential to inform optimal intra- and inter-sectoral water allocation as well as the formulation of national and catchment water policies. Water footprint assessments of national consumption can illuminate where in the world countries have their biggest freshwater impacts and answer questions such as do we get water intense products from water scarce countries? National footprints have not yet influenced public policy directly, but have broadened thinking and taken the global dimension of water use into account.

### Scenarios – managing uncertainty and planning for surprises

Climate variability and change and rapid global economic changes and financial uncertainty make conventional approaches to managing our water resources on the basis of historical trends difficult. In an increasingly uncertain environment, it is important to better understand the biophysical and social drivers that threaten to bring abrupt changes, regime shifts, in water systems, as well as understanding management options to try to establish safe threshold levels to protect the systems' resilience. This is also true of governance and decision-making systems and the institutional ability to be responsive and flexible to address drivers of change rather than represent vested interest and perpetuate the status quo. Protecting resilience of water systems requires a different perspective to embrace uncertainty and the willingness to act now on the basis of known indicators of change through a “no regrets” approach even before the dynamics of regime change are fully understood. A better understanding of drivers of change and future uncertainties can assist better decision making. Scenarios and the application of various numerical hydrological and economic modelling tools are increasingly prominent to identify and evaluate response options and effective courses of action.

The World Water Assessment Programme is developing a second generation of water scenarios globally, that will incorporate additional driving forces and update existing global scenarios, to be published in the UN World Water Development Report 2012. Four scenarios will be developed based on assessment of a wide range of driving forces: climate change, water resources, demographic changes, governance institutions, technology, economics and security, ethics, agriculture, infrastructure, and politics. The focus on risk and uncertainty linked to global changes aims to inform political decision-making.

### Governance tools to support better decisions

Governance sets the stage for water management decisions and is critical for citizens and water consumers to exercise their rights, negotiate and mediate competing demands, and form partnerships. However, the water sector is to a large extent driven by technocrats with a strong focus on water supply driven infrastructure development and governance is poorly understood.



Photo: Getty Images

Tools like governance performance benchmarking can help to demystify governance, give it concrete, practical content, and guide priority setting and implementation of sector reform.

Processes for negotiating mutually agreeable outcomes from competing demands by a range of parties at local, regional and even transboundary levels were presented in IUCN's toolkit "NEGOTIATE" which aims to help water users to negotiate workable, fair and lasting agreements on how to best manage water resources and resolve disputes. The "4Rs" framework of rewards, risks, rights and responsibilities to structure, analyze and understand the diverse interests broadens possibilities to accommodate them.

The human right to water and sanitation provides a framework and standard to improve equity in the provision of safe water and sanitation. It can help increase transparency and accountability, clearly define rights and responsibilities, and strengthen participation towards non-discriminatory and pro-poor service provision. A human rights based approach may also improve the social equity of water allocation and improve benefit sharing in integrated water resources management, and may help assess the effectiveness of IWRM implementation.

### Conclusions

Despite wide understanding of the benefits of integrated approaches to addressing competing demands in equitable and mutually beneficial manners, weak institutional capacity, continued sectoral fragmentation, and low prioritisation by finance ministries continue to be major impediments to better governance and management of water resources.

A 'revolution' in communication is needed to facilitate a mind-set change and advance education and organisational learning both in the public and government domains. Where visionary leadership is in place, positive change is possible and evident. Experts should be encouraged by this and team up with local champions and facilitate communication on innovative approaches to shared use of water and benefit sharing, to stimulate wider stakeholder involvement. Regulation and economic tools may often only play a supportive role, so institutional change and capacity development to support 'voluntary' partnerships for action between wider stakeholders should be a key area for advancement of 'integrated management'.

Growing momentum in corporate water accounting and footprinting, increasing sophistication in monitoring and mitigating water pollution, and experience with existing benefit sharing successes support progress in quantifying costs and benefits of integrated approaches to balancing competing demands on water resources. Such approaches should be scaled out and developed in a localised context where actors with shared interests and claims work towards sustainable management of water resources and equitable benefit sharing.

Agricultural production needs to take a prominent place in water policy globally to address the growing water pollution and demand concerns it poses. Agricultural practices need to be addressed in a systemic fashion to alleviate both water demand and land use based pollution, and recycling and reuse will play a growing role in meeting demand.

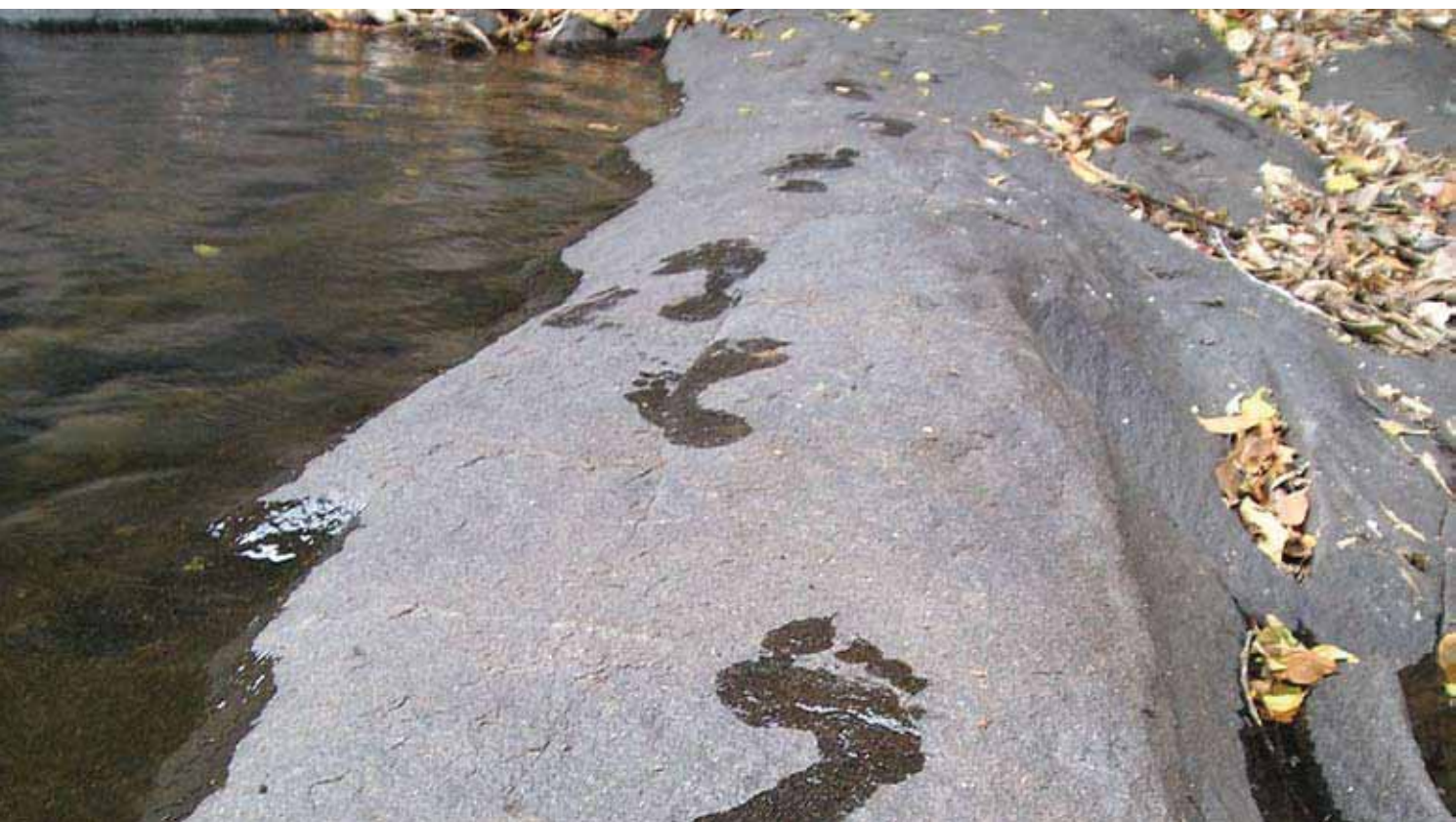


Photo: Juan Santiago/SXC



# Responding to Socio-economic and Demographic Changes

**Lead Rapporteurs: Dr. Graham Alabaster and Prof. Hubert Savenije**

**Junior Rapporteurs: Ms. Cecilia Kalin, Ms. Helen Legeby, Ms. Suvi Sojamo and Mr. Lan Wang**

## Context

The world's population is due to rapid changes. Urbanisation, population growth and rising living standards are socio-economic and demographic changes particularly pronounced in emerging economies and developing countries. According to recent estimates, by 2050 the world's population will grow from today's 6.8 billion to approximately 9.3 billion people, of which 70 per cent will be urban dwellers. In combination with increasing wealth and change of lifestyle, the synergistic implications for water supply and sanitation resources as well as for the global ecosystem become problematically self-evident.

The United Nations General Assembly's resolution on 28 July 2010, defining access to clean water and sanitation as a human right, sets an important landmark illustrating the political will to tackle the water crisis. However, despite the regional success stories towards reaching the Millennium Development Goals, more than 2.6 billion people still lack access to basic sanitation and approximately 884 million people do not have access to safe drinking water. Sanitation, lagging more severely behind from the targets, demands for focused attention whereas responding quickly and comprehensively to the growing pressure on

water supply leading to conflicts on resource allocation asks for cross-sectoral involvement. The water sector cannot tackle balancing the supply and demand alone. The need to respond applies to every sector of our society, and a system approach is increasingly called for in the sustainable development of water management. In practice, implementation of this holistic understanding remains still incomplete.

When looking at especially water quality challenge from the perspective of responding to socio-economic and demographic changes, improved knowledge of different system levels and empowerment of their associated capacity were called for throughout the 2010 World Water Week. The systems highlighted here include communities in the developing world with special emphasis on young women, growing urban areas of different sizes and global political economy.

## Major insights

**Education and empowerment of young women on water and sanitation.** Women are the main managers of water, sanitation and hygiene in communities in the developing world. They are the biggest beneficiaries and most efficient implementers of improved

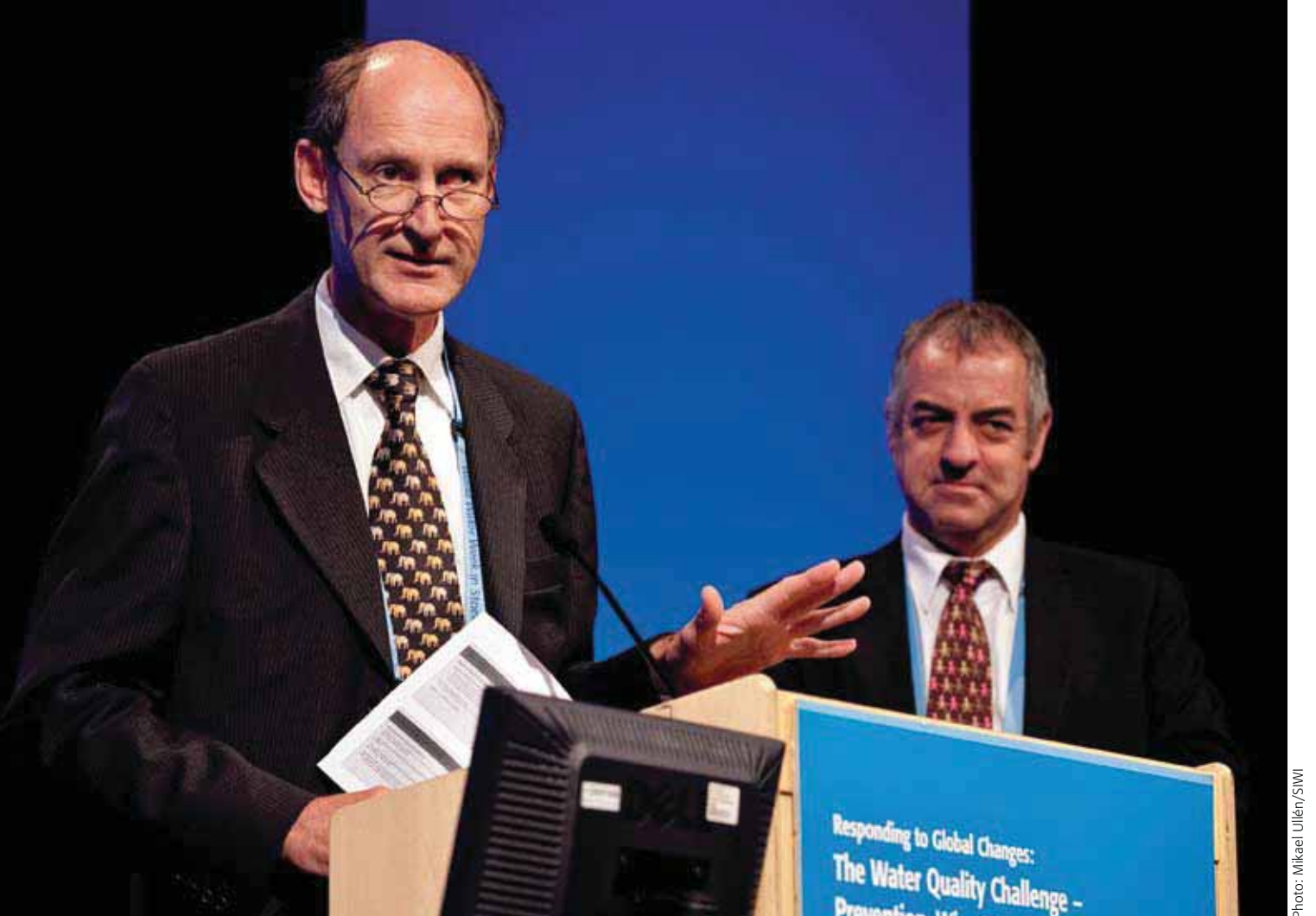


Photo: Mikael Ullén/SIWI

Lead rapporteurs Prof. Hubert Savenije and Dr. Graham Alabaster see the need to prioritise empowerment of young women via sanitation in order to challenge taboos, improve their economic status and education.

practices. However, the capacity of women is still under-utilised in developing more sustainable management solutions and their opportunities undermined due to lack of education. Lack of basic sanitation and inadequate water quality in the growing communities cause cholera outbreaks, diarrhoea and other diseases. Moreover, young women tend to drop out of school when they reach puberty, due to lack of sanitation facilities. Many women have no access to sanitary pads or waste disposal facilities and the information on hygiene management is often poor due to cultural and religious taboos. There will need to be major improvements especially in the mentioned sanitary and hygiene issues with consideration that they are intertwined with promotion of gender equality and empowerment of women, ultimately underlying the well-being of whole developing communities.

**Flexible urban systems to meet the changeability of the future.** Whereas the growing mega-cities are struggling with the capacity of their existing ageing sewer systems, the new urban growth and urban sprawl takes increasingly place outside the former cities merging the surrounding areas together thus creating informal cities with no or very little water supply or treatment infrastructure. Rising living standards and growing consumption associated with urbanisation set an extra pressure on the urban water management system. The rapid uncontrolled changes lead to uncertainty of the future and

demand for proactive approach with flexible solutions in different scales and application of precautionary principles in urban water management.

**Changing world order.** In the global political economy, water quality and quantity are managed in an intertwined manner on a water-food-energy nexus. The dynamics of the nexus are increasingly complicated by climate change and shifting consumption and dietary patterns. Most importantly, the water footprints of the decisions made on the nexus are increasingly located in other parts of the world than the decision makers themselves. Moreover, besides traditional national and public institutions, new actors are occupying the water field. Increasing foreign and private transnational investment in water poses both opportunities and challenges for sustainability of water quality and quantity.

### Opportunities for progress

**Education and empowerment of young women on water and sanitation.** With adequate sanitation facilities young women get the opportunity to complete their studies, and education in schools on sanitation and hygiene management can affect the health and well being of the whole community. Education can also be used to spread simple and effective ways to purify water. An illustrative example is the Stockholm Water Prize Laureate



Dr. Rita Colwell's ingenious method to reduce cholera bacteria in drinking water through filtration with saris. Another example of a simple way to purify drinking water, promoted by John G. Kariuki from the Ministry of Public Health and Sanitation in Kenya, is solar disinfection by exposing water to sunlight in a plastic bottle. These examples show that efficient low-cost local solutions can be found with a little creativity and thinking-out of the box. They should also be applied in challenging cultural taboos. Access to sanitary pads and disposal facilities could be improved with micro-credit loans to women who could start small scale businesses that provide these goods to the local community. Additionally, this would be a way to empower women economically.

Furthermore, an opportunity for progress for the whole young generation in low income countries are the new types of media. When young people in rural areas get access to the Internet they have access to an information base without limits.

**Urban-rural integration.** The idea that urban areas and rural areas are not divided but rather in transition is growing stronger and open up possibilities for benefit-sharing. If waste water from urban areas could be used in irrigation of agriculture it could feed up to 10 per cent of the world's population. Hence, growing urban waste water problem could be turned into an opportunity for rural areas via increasing their water supply. In urban water management, centralised solutions should be increasingly accompanied with decentralised localised alternatives. Management institutions should be more cluster-like in their function – as big as possible but as small as necessary. Today many cities transport their water from further and further upstream parts instead of treating and sanitising their local sources. This trend results in longer pipelines that are difficult to manage. This neglecting of the local supply leads to further contamination and deterioration of the urban water management systems.

**Leapfrogging opportunities for large emerging nations.** The leading emerging economies, especially China and Brazil, are increasingly investing in new innovative solutions in water supply and demand management, sanitation and waste water treatment. They are among the forerunners in building the new 'green economy', leapfrogging to the adoption of the most advanced technologies and integrated water management approaches with high yielding investments. Especially China is an active investor outside its own borders, funding large scale water infrastructure projects across the developing world, particularly in Africa.

**Increasing corporate engagement.** Besides the rising national economic giants, transnational corporations and private investors are also funneling more money into water research and development projects and paying more attention to the overall water integrity and accountability of their actions. Corporations with financial and technological capacity are building bridges between the 'trust owners', NGOs and the scientific community,

hence constructing flexible global water governance networks. Diversity of corporate investment options and flexibility of their funding scales also enable quicker location specific low cost solutions to water management.

### Challenges for progress

**Cultural and religious taboos.** Low income countries need more investments in sanitation facilities in schools in order to prevent young women from dropping out of the educational system after they reach puberty. Cultural and religious taboos have to be challenged by bringing the issue to policy agendas and by encouraging small scale businesses providing women with sanitary pads and waste disposal facilities.

**Foreign investment and the risk for neocolonialism.** Foreign and private investment in land and water can also have a downside when the resources are 'grabbed' from the local communities. In order to secure their increasing domestic demand, investors mainly from the Eastern Asia and Arab world and transnational corporations originating from the US and Europe are negotiating long term leasing agreements of land and water resources in countries in Africa that are themselves tackling with water and food insecurity. Hence the foreign investment in land and water poses also a risk of neocolonialism.

**Limitations of private sector engagement.** When it comes to the private sector involvement, despite the increasing stakeholder scrutiny there is a risk of corporations hijacking the discourse on water governance and water footprinting for their own advocacy purposes. Moreover, there is a lack of understanding of the importance of global supply chains and networks in global water management of virtual water flows as the private sector approach is still very much limited to basin specific water use issues concerning specific operations. Stockholm Water Prize Laureate Professor Tony Allan among others emphasised throughout the week that major decisions on global water security regarding both water quantity and quality are made in water intensive agro-food supply chains by farmers, global traders, retailers and ultimately by consumers.

**Chemical pollution and water reuse.** Chemicalisation of consumption and rising water quality standards pose new challenges for urban water management. Whereas in the developing countries waste water can mostly be recycled for re-use and the biggest obstacles are in the lack of political will and funding in implementing existing techniques, rather than in their availability, urban areas in the developed world are facing a new, creeping water quality problem. The Malin Falkenmark Seminar discussed the effects of large consumption of drugs in developed countries. Emergent pollutants end up in the water with consequences there are little knowledge about and the effects on human fertility may have a long-term impact on world population.

Heavier traffic and storm water surges and other extreme climatic events pose an additional burden on urban water man-

agement infrastructure and water quality both in the developing and developed world. Overflow of sewage storage during peaks in rainfall lead to widespread contamination of urban water supply. Instead of rebuilding the whole urban water infrastructure, flexible scales of solutions and application of precautionary principles are the keys to increasing resilience of urban water management in all of the mentioned cases. Small steps make bigger differences and they are more sustainable than risky direct leaps to best existing technology with insecure funding.

### Conclusions and recommendations

To conclude, the following recommendations were provided by the 2010 World Water Week as a way forward:

- **Prioritise empowerment of young women in local communities via improved sanitation.** To improve the education on hygiene and sanitation politicians have an important responsibility to prioritise this area and overcome the cultural taboos. Financial support in forms of national investments, ODA funding and microcredits will be needed in order to improve access to sanitary pads and disposal facilities, as well as sanitation facilities in schools.
- **Use information technology for information dissemination.** New media, wireless Internet access and computer facilities should be provided in rural and poor areas to facilitate information dissemination and empowerment of the new generation of water users and managers.

- **Take into account full supply chains in corporate water reporting.** Global standards taking into account geographical setting and performance data are needed in corporate water reporting to enable sustainability comparisons. All the water users in different stages of supply chains should be brought into the global water governance and under stakeholder scrutiny.
- **Clear guidelines for foreign and private investment in land and water.** Clearer guidelines are needed in order to protect local communities from resource grabbing, but binding frameworks need to be considered carefully as adjusting national legislation does not necessarily provide rule of law to the poorest and least privileged.
- **Limit chemicalisation of production and consumption.** Considering the persistent characteristics of the new emerging pollutants, the precautionary principle justifies an overall quantitative as well as qualitative limitation at the first step of the chemical dispersion chain.
- **Diversify management system scales according to local needs and future trends.** The diversity and uncertainty of the future requires adaptable and resilient systems, especially in dynamic urban areas. The right scale of management solution is a key parameter of its sustainability.
- **Gain wealth but stay water frugal!** Sunita Narain's absolute catch-phrase summarises the key to sustainable water management for all when responding to socio-economic and demographic changes.



Photo: Frida Lanshammar



# Ensuring Human and Environmental Health

**Lead Rapporteurs: Dr. Thomas Chiramba and Ms. Jennifer De France**

**Junior Rapporteurs: Ms. Lyaila Ibraimova, Mr. Babar Khan, Ms. Chibesa Pensulo and Ms. Sarah Segal**

## Context

Human and environmental health is inextricably linked with water quality. In the past, water quality has been considered only at the interfaces with human use, but now there is a considerable growth in understanding of the need to manage water quality to ensure ecosystem health as well.

It is well known that unsafe water contributes to a large disease burden. The second leading contributor to global disease is diarrhea which results in 2.2 million deaths, where the majority of cases are attributed to unsafe water, inadequate sanitation and hygiene. There is increasing evidence that water quality can significantly impact ecosystem health as well. Excessive nutrients into a water body, for instance, can lead to eutrophication – the over-productivity of organisms in water – leading to the creation of algal blooms and the depletion of oxygen concentrations, which threatens many animal and plant species (Carr and Neary 2008). One study on the extinction of freshwater fish found that water quality impacts contributed to 26 per cent of extinctions (in Revenga et al. 2000)

Past failures to address the multiple drivers of water quality problems that affect human and ecosystem health have the potential to become more severe as they are compounded by population growth, water shortages, and climate change. Yet there is a need to continue striving for safe water for all (both human and aquatic systems), considering water quality's pivotal role in human and economic development.

Ensuring human and environmental health is a multi-faceted challenge, but progress in improving water quality will be a large step in the right direction. This goal was the subject of several discussions during this year's World Water Week.

## Major insights

Three related and most important areas of action have been identified: (1) Emerging research on the complex environmental interactions with microorganisms (2) Better integration between public health and environmental sciences (3) Promotion of the ecosystem approach.

**Emerging research:** Throughout the week, cutting-edge research was presented that sheds light on the linkages between water quality, human health and environmental health. The 2010 Stockholm Water Prize Laureate Dr. Rita Colwell shared promising research which shows how changes in climate, adverse weather events, shifts in ocean circulation and other ecological processes can create conditions that allow infectious diseases such as cholera to spread. As a result of this and future work, scientists will be able to better predict and prevent infectious disease outbreaks with the use of environmental indicators. This research clearly shows the interconnectedness of the environment, water quality and human health.

There is a growing concern about the potential effects of pharmaceuticals and other personal care products, xenobiotics and emerging pollutants on human and environmental health. These



Photo: Mikael Ullén/SIWI

Ms. Jennifer De France and Dr. Thomas Chiramba highlight the linkages between water quality, human and environmental health and conclude that building resilience is imperative.

substances originate from a variety of activities, including from industrial, agricultural, medical and household activities. Several of these substances are known to have negative effects on human health and on the environment. Yet the exact extend of the effects and the behaviour of these substances, as well as their cumulative impacts, is not yet well understood and hard to predict.

Another emerging area of research is related to regime shifts and tipping points concepts, where there is increasing evidence that there is a threshold in terms of amount of water abstracted/ water quality degradation beyond which the ecological functioning is altered and or collapses irreversibly. However, there is still a lack of scientific understanding of these processes, yet there is a need to begin identifying indicators and developing management approaches to address this issue.

**Human and ecosystem health:** The international community increasingly recognises the important links between environmental health, human health and overall well-being, and emerging research further supports these linkages. Yet in practice, integration between public health and environmental sciences rarely takes place. The lack of integrated strategies and perspectives in this area contributes to high incidences of water-related diseases, poor water quality, inadequate quality of food and low incomes from agriculture i.e. depletion of livelihoods and human wellbeing.

**Ecosystem approach:** The ecosystem approach supports the integrated management of land, water and living resources

that promotes conservation and sustainable use in an equitable way. This approach brings together the most current scientific understanding of ecosystems with community participatory approaches, to help people resolve situations in which problems interact in complex and often unexpected ways. The application of the ecosystem approach can lead to better water management, less disease transmission, improved environmental conditions, less pollution through better pest control and monitoring of non-point sources, better quality of food production, and economic development.

Environmental resources, fragile ecosystems and subsequently human health are in danger mainly because of inappropriate actions or inaction in many levels. During the week it has been highlighted that an important component of protecting water quality for health is the building and enhancing of resilience at all levels, from the local to the national and international. By recognising the importance of protecting water quality for health, placing this within the context of an ecosystem management approaches, and developing and implementing policies and practices now, it is possible to build community and ecosystem resilience to global environmental change.

### **Challenges and obstacles to progress**

**Information for decision making:** A key obstacle to progress is the inherent difficulty in communicating scientific information in a manner that decision makers can understand and respond

to. The science-policy gap is yet to be bridged, and this is perhaps one of the reasons why the MDG target on sanitation will not be met. For decision makers at all levels (household, municipal, national and international) to fully understand the need for and value of improved water quality, water supply, sanitation and ecosystem management, the benefits must be presented to them in compelling economic terms. Some progress has been made in conducting cost-benefit analyses of water supply and sanitation improvements, but more work needs to be conducted in this area. Furthermore, economic costing of ecosystem services is complex and difficult to achieve.

**Behavioural, cultural and equity factors:** The socio-cultural dimensions of our interactions with the environment present a host of obstacles. Behavioural change around such matters as sanitation and hygiene has been shown to be possible through interventions such as Community-Led Total Sanitation (CLTS). However, efforts to address behavioural and cultural change are often met with resistance or even outright opposition. An example raised during the World Water Week was the refusal of some ethnic groups to use chemical water treatment at household level, claiming that it is taboo. There is a need to better understand the determinants of behaviour modification to initiate and support sustainable change.

Equity also remains a continuing challenge – women, children, the disabled, the poor, and rural populations are still lagging behind in access to potable water and improved sanitation. This is supported by the 2010 report from the WHO/UNICEF Joint Monitoring Programme (JMP) for water supply and sanitation. For example, the Report shows that the poorest quintile is 16 times more likely than the richest quintile to practice open defecation while the richest quintile is more than twice as likely than the poorest quintile to use an improved drinking-water source.

**Enforcement mechanisms:** While some progress has been made internationally in ensuring environmental health such as the adoption of the UN Convention on Shared Watercourses of 1997, international law enforcement mechanisms remain weak. Most countries have devised national legislation protecting water quality, but enforcement of these laws is also weak, particularly in poorer countries. Often, the immediate benefit obtained from activities that might impair water quality is valued above the cost to society from this impairment. Externalities are not adequately considered.

### Opportunities for progress

**Paradigm shifts:** The paradigm shift advocated for throughout the week presents huge opportunities for progress. A shift was advocated for in the form of viewing ‘waste’ more as a resource for a world faced by increasing demand for resources including water. Safe reuse of waste water is an opportunity. A shift was also perceived essential in the approach of dealing with waste- and



Photo: Anna Norström

storm -waters, the approach of draining these out of built up areas emanating from the Roman times needs now to be revisited in line with circumstances that have dramatically changed.

**Trans-disciplinary research:** Our recognition of environmental and human vulnerability to unpredictable climate change patterns has opened up more horizons for transdisciplinary research, to enhance resilience. Undertaking trans-disciplinary research on the environment and health presents a huge opportunity to make progress.

**Evolving frameworks:** The UN Convention on Shared Watercourses of 1997; the recent finalisation of the International Law for managing groundwater and aquifers and the adoption by the General Assembly of water as a human right this year present opportunities for making progress in addressing water quality for human and environmental health. More needs to be done for the incorporation of these into domestic laws and their subsequent effective application at national level.

**Polluter Pays principle:** Better application of the ‘polluter pays’ principle is required to control industrial pollution of freshwater resources. As long as the penalty for pollution is less than the cost of preventing it, there will be no reduction in pollution. Additionally, the use of international law principals can continue to guide the regulation of pollution by addressing the outsourcing of industrial production from developed to developing countries.

**Holistic approaches:** Systematic, preventive approaches to managing water quality are needed. Water Safety Plans, which are recommended in WHO’s Guidelines for Drinking-water Quality, are increasingly acknowledged as the most effective means of delivering safe drinking water supplies through identification and mitigation of risks from catchment to point of use. Throughout the Week, numerous experiences with Water Safety Plans were shared, from a water supply to national perspectives. Currently, WHO is developing a similar approach, called Sanitation Safety Plans for management of wastewater, excreta and grey water. It was also highlighted that health and sanitation needs to be better integrated into IWRM and that. Water Safety Plans and Sanitation Safety Plans provide the obvious linkages with IWRM and could feed into the IWRM process.

**Building on small successes:** Household water treatment and safe storage (HWTS) is increasingly being recognised as an effective and inexpensive technique to improving and maintaining safe supplies of drinking-water, particularly in areas where safe supplies are not being provided in the home and during emergency situations. However, it was recognised that HWTS is an important complement to the suite of broader water, sanitation and hygiene interventions and should be promoted alongside these interventions.

**International initiatives:** Some international initiatives present some opportunities. The UNEP-led *Green Economy Initiative* can support governments in achieving better water and

waste management, to improve human health and livelihoods, as well as to maintain ecosystem integrity and environmental sustainability.

*Sanitation and Water for All*, a global partnership to achieve universal and sustainable access to sanitation and drinking water, has evolved out of the Global Framework for Action discussed during the 2009 World Water Week. Sanitation and Water for All has so far hosted its first High Level Meeting, which resulted in commitment of USD 1 billion of external aid to the sector. This initiative has the potential to speed up progress towards meeting the MDG targets on water supply and sanitation.

## Recommendations

**Adopt sustainable models:** A primary recommendation to emerge has been the need to learn from the past. For example, workshops focused on the need to examine how new crop varieties, agricultural practices and land use can improve both ecosystem and human health. Specifically, irrigation and fertilisers need to account for the sustainable use of groundwater and fertilisers need to take into account the concept of “peak phosphorus” as well as the potential pollution impacts of fertilisers on water resources. Sustainable models in the future will see the linkages between the need for phosphorus in the future and the potential for ecological sanitation strategies to provide phosphorus from urine. Innovative, holistic approaches that address water scarcity and quality in combination with the increasing water and sanitation needs of a growing population will contribute to human and environmental health.

In addition, construction of dams in a manner that supports transboundary water sharing and environmental health is a complex but important issue both at micro and macro level. Bridging the gaps among all the stakeholders and adopting the principles of IWRM can lead to productive and sustainable solutions.

**Revolutionise the institutional setting:** Inappropriate institutional settings and related policies and incentive mechanisms that have failed to address water quality for both human and ecosystem needs are key recommended areas to address. An institutional revolution is needed, which examines the most effective institutional arrangements to address water quality problems. Specifically, this year’s workshops recommended to focus on examining standards directed at drinking water and introduced the notion of expanding standards to include standards directed at ecosystem health. The role of standards and institutional roles is a direct way to move forward on more effective water quality management.

There is need for institutional arrangements that promote collaboration between environmental and health specialists. Furthermore, institutions should play a key role in promoting partnerships at all levels. Without innovative partnerships such as between the private sector and national governments it will be



difficult to address health issues related to water quality. Increasing the role of various stakeholders, such as farmers, directly related to water quality issues will reinforce policy.

**Get the messages out:** As in previous years, the role of behavioural change was a prominent topic. A key recommendation in this report is to target individual behaviour, recognising that this requires innovative and targeted messaging that is culturally and context specific. This relies on an effective communication strategy that promotes environmentally and human-health conscious alternatives as well as communication strategies that targets multiple stakeholders.

Education remains a key element of future change and the concept of education beyond the classroom is another key recommendation. While the importance of implementing sanitation education in schools has been examined, the concept of broader education and awareness and the means of explaining the relationships between environmental flows and human health need to be addressed. For example, the challenge of gaining community support for wastewater treatment and reuse in certain communities where water is not abundant requires education on the health impacts of untreated human waste.

**Political commitment:** The international water sector should strive to raise awareness at political level to prioritise sustainable water supply and sanitation. This need was reflected repeatedly throughout the week and was also one of the key recommendations in the Global Annual Assessment on Sanitation and

Drinking-water (GLAAS) 2010 report, which aims to elucidate where efforts are needed to achieve the MDG target on drinking-water and sanitation. Specific examples recalled during the week including in Africa where there are shared river basins; greater political commitment is required to enable monitoring of water quality at the basin level. Another example is the role of government in implementing HTWS; national policy plays a critical role in their introduction.

### Conclusions

The 2010 JMP Report indicates that the world is on track for meeting the MDG target for drinking-water while the world is off track to meet the sanitation target. However, the indicators used for drinking-water (improved and unimproved sources) do not adequately address the safety aspect of the source and therefore, the actual situation is much more dire than portrayed by the JMP numbers. Furthermore, as researchers and practitioners in the fields of water supply, sanitation, health, and environmental protection, we need to look beyond the MDGs if sustainable solutions to the world's current health and environmental challenges are to be found. Meeting these targets, while definitely commendable, should not be seen as an end in itself. Holistic approaches that recognise human and environmental health as interdependent will become increasingly essential as the human population and our impact on the environment continue to grow.



# Convening Organisations

- ABT Associates
- Acacia Water
- ACRA (Associazione di Cooperazione Rurale in Africa e America Latina)
- African Development Bank (AfDB)
- African Groundwater Network (AGW-net)
- African Ministers' Council on Water (AMCOW)
- African Network of Basin Organisations (ANBO)
- African Water Facility (AWF)
- Agence Française de Développement (AFD)
- AguaJaring
- Alliance for Water Stewardship (AWS)
- Alterra Wageningen
- Americas Water Forum (AWF)
- Aqua for all (A4A)
- Asian Development Bank (ADB)
- Asian Pacific Water Forum (APWF)
- Australian Agency for International Development (AusAID)
- Better Cotton Initiative (BCI)
- Bill & Melinda Gates Foundation
- Black & Veatch Corporation
- Blue Gold Marketing
- Both ENDS
- British Geological Survey
- Building Partnerships for Development in Water and Sanitation (BPD)
- Capacity Building International (InWent)
- Cap-Net – Capacity Building for Integrated Water Resources Management
- Center for Agricultural Research and Ecological Studies (CARES)
- Center for Integrated Water Resources Management (ICIWaRM)
- Centers for Disease Control and Prevention (CDC)
- Centre for Ecology and Hydrology (CEH)
- Centro Agua, Bolivia
- Challenge Program on Water and Food (CPWF)
- Church of Sweden
- City of Marseille
- City University of New York Environmental Cross-Roads Initiative
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) Water for a Healthy Country Program
- Conservation International (CI)
- Cooperative Programme on Water and Climate (CPWC)
- Danish Institute for International Studies (DIIS)
- Danish Ministry of Foreign Affairs
- Danish Water Forum (DWF)
- Delta Alliance (DA)
- DHI Water and Environment
- DIVERSITAS
- Dutch Ministry of Agriculture, Nature and Food Quality (LNV)
- East West Institute (EWI)
- Ecologic Institute
- EUREAU (European Federation of National Associations of Water and Waste Water Services)
- European Commission (EC)
- European Environmental Agency (EEA)
- European Investment Bank (EIB)
- European Water Partnership (EWP)
- EUWI African Working group (AWG)
- Federal Environment Agency, Germany (UBA)
- Federal Institute for Geosciences and Natural Resources, Germany (BGR)
- Federal Institute of Hydrology, Germany
- Federal Ministry for Economic Cooperation and Development, Germany (BMZ)
- Federal Ministry for Environment, Nature Conservation and Nuclear Safety, Germany (BMU)
- FEMSA Foundation
- Finnish Environment Institute (SYKE)
- Finnish Water Forum (FWF)
- Food and Agriculture Organization of the United Nations (FAO)
- Foro de los Recursos Hídricos Ecuador
- French Development Agency (AFD)
- German Government
- German Technical Cooperation (GTZ)
- Global Environmental Flows Network (eFlowNet)
- Global Water Operators Partnership Alliance (Global WOPs Alliance)
- Global Partnership on Output-Based Aid (GPOBA)
- Global Water Partnership (GWP)
- Global Water System Project (GWSP)
- Google
- Government of France
- Green Cross
- H&M
- Helmholtz Centre for Environmental Research (UFZ)
- Household Water Treatment (HWT) Network
- IHP/HWRP Secretariat
- IKEA
- Institute of Development Studies, UK
- Integrated Project Water and Global Change (WATCH)
- Inter-American Development Bank (IDB)
- Inter-American Association of Sanitary and Environmental Engineering (AIDIS)
- International Association of Hydrogeologists (IAH)
- International Association of Hydrological Sciences (IAHS)
- International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B)
- International Centre for Integrated Mountain Development (ICIMOD)
- International Development Research Centre (IDRC)
- International Finance Corporation (IFC)
- International Institute for Environment and Development (IIED)
- International Hydropower Association
- International Network of Basin Organizations (INBO)
- International Office for Water (OIEAU)
- International Resources Group (IRG)
- International Rivers (IR)
- International Union for Conservation of Nature (IUCN)
- International Water Association (IWA)
- International Water Management Institute (IWMI)
- IRC International Water and Sanitation Centre
- Italian Committee for the World Water Contract (CICMA)
- ITT Corporation
- KfW Entwicklungsbank (KfW)
- King's College London (KCL)
- Korea Water Resources Corporation (K-Water)
- Lake Victoria Basin Commission (LVBC)
- Latin America Water, Education and Training Network (LA-WETnet)





Photo: Michael Moore

- London School of Hygiene and Tropical Medicine (LSHTM)
- Managed Aquifer Recharge Network (MAR-NET)
- Marks and Spencer (M&S)
- McKinsey and Company
- Mercy Corps
- Meta Meta
- M-POWER Network (Mekong Program on Water, Environment and Resilience)
- National Institute of Public Health, Japan
- National University of Singapore (NUS)
- National Water Commission of Mexico (CONAGUA)
- Network of Asian River Basin Organisations (NARBO)
- Nile Basin Capacity Building Network in IWRM (Nile IWRM-net)
- Nile Basin Initiative – Nile Equatorial Lakes Subsidiary Action Program (NBI-NELSAP)
- Nitlapan (Nicaragua)
- Nordic Agency for Development and Ecology (NORDECO)
- Nordic Environment Finance Corporation (NEFCO)
- Nordic Investment Bank (NIB)
- Oregon State University (OSU)
- Pacific Institute
- PATH
- Population Services International (PSI)
- pr audit
- RAIN Foundation (RAIN)
- Ramsar Convention on Wetlands
- Royal Swedish Academy of Sciences
- Sanitation and Water for All (SWA)
- SCENES Project (Water Scenarios for Europe and Neighbouring countries)
- Siemens Water Technologies
- Slumdweller International
- Soesma
- Southern and Eastern Africa Rainwater Harvesting Network (SEARNET)
- Stakeholder Forum for a Sustainable Future
- State Oceanic Administration, China (SOA)
- STEPS Centre, University of Sussex, UK
- Stockholm Environment Institute (SEI)
- Stockholm International Water Institute (SIWI)
- Stockholm Resilience Centre (SRC)
- Swedish Environmental Protection Agency
- Swedish Institute for Infectious Disease Control
- Swedish International Development Cooperation Agency (Sida)
- Swedish International Hydrological Programme (Swedish IHP)
- Swedish Meteorological and Hydrological Institute (SMHI)
- Swedish Ministry for Foreign Affairs
- Swedish Water House (SWH)
- Swiss Agency for Development and Cooperation (SDC)
- Swiss Federal Institute of Aquatic Science and Technology (Eawag)
- Tearfund
- The Nature Conservancy (TNC)
- UN Independent Expert on the Issue of Human Right to Water and Sanitation
- United Nations Children's Fund (UNICEF)
- United Nations Convention to Combat Desertification (UNCCD)
- United Nations Development Programme (UNDP)
- UNDP Water Governance Facility at SIWI (WGF)
- United Nations Economic Commission for Europe (UNECE)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- UNESCO - Institute for Water Education (UNESCO-IHE)
- UNESCO - International Centre for Coastal Ecohydrology, University of Algarve, Portugal (ICCE)
- UNESCO - International Hydrological Programme (UNESCO-IHP)
- UNESCO Etexa
- United Nations Environment Programme (UNEP)
- UNEP - Division of Technology, Industry and Economics (UNEP DTIE)
- UNEP - DHI Centre for Water and Environment
- UNEP - Finance Initiative (UNEP FI)
- United Nations Global Compact (UNGC)
- United Nations Human Settlements Program (UN-HABITAT)
- United Nations Industrial Development Organization (UNIDO)
- United Nations Secretary-General's Advisory Board on Water and Sanitation (UNSGAB)
- United Nations University Institute for Environment and Human Security (UNU-EHS)
- United Nations University Institute for Water, Environment and Health (UNU-INWEH)
- UN-Water
- UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC)
- UN-Water Decade Programme on Capacity Building (UNW-DPC)
- United States Agency for International Development (USAID)
- United States Department of State
- University of Bamako, Mali
- University of Leeds, UK
- University of Twente, The Netherlands
- Wageningen University and Research Centre (WUR)
- WASH in Schools
- Water Alternatives
- Water and Sanitation Program (WSP)
- Water Center for Latin America and the Caribbean (CAALCA)
- Water, Engineering and Development Centre (WEDC) at Loughborough University, UK
- Water Environment Federation (WEF)
- Water Footprint Network (WFN)
- Water Integrity Network (WIN)
- Water Observatory of the Fundacion M. Botin (MBF-WO)
- Water Resources Research Centre, Hungary (VITUKI)
- Water Supply and Sanitation Collaborative Council (WSSCC)
- WaterAid
- WaterNet
- Wetlands International (WI)
- World Bank (WB)
- World Bank Groundwater Management Advisory Team (GW-MATE)
- World Business Council for Sustainable Development (WBCSD)
- World Estuary Alliance (WEA)
- World Health Organization (WHO)
- World Ocean Week (WOW)
- World Water Assessment Programme (WWAP)
- World Water Council (WWC)
- World Wide Fund for Nature (WWF)
- WSP Network in Latin America and the Caribbean (WSP-LAC/Net)
- Xiamen Municipal Government

## 2010 Stockholm Water Prize



On the evening of September 9 2010, Dr. Rita Colwell, distinguished Professor from the University of Maryland and Johns Hopkins University's Bloomberg School of Public Health in the United States, received the Stockholm Water Prize from the hands of H.M. Carl XVI Gustaf of Sweden. During her career, Dr. Colwell has bridged the forefront of science and technology with a lifelong dedication to craft practical solutions to provide access to clean drinking water and protect human and ecosystem health. She has helped create the study of bioinformatics, a field that combines biology, computer science and information technology and has advanced the understanding, diagnosis, treatment, and prevention of many genetic diseases. She has also led the adoption of remote sensing technology to track the movement of diseases globally. Today, she is widely recognised as one of this century's most influential voices in science, technology, and policy associated with water and health.

Dr. Colwell was awarded the Stockholm Water Prize for her pioneering research on cholera and other water borne diseases, which has helped protect the health and lives of millions.

"Dr. Rita Colwell's numerous seminal contributions towards solving the world's water and water-related public health problems, particularly her work to prevent the spread of cholera, is of utmost global importance", noted the Stockholm Water Prize Nominating Committee in its citation. "Through her research on its physiology, ecology, and metabolism, Dr. Colwell advanced the fields of mathematics, genetics and remote sensing technology and not only as they relate to these bacteria but to

the prevention other diseases in many developing countries."

At her Laureate Lecture at the Opening of the 2010 World Water Week, Dr. Colwell stressed the need to increase attention on the effects of worsening water quality on human health and security. "Safe drinking water is absolutely critical to economic stability, social stability and even national security", she said.

### About the Stockholm Water Prize

The Stockholm Water Prize is a global award founded in 1991 by the Stockholm Water Foundation and administrated by Stockholm International Water Institute. It is presented annually to an individual, organisation or institution for outstanding water-related activities. The Stockholm Water Prize Laureate receives USD 150,000 and a crystal sculpture specially designed and created by Orrefors. 2010 marks the 20<sup>th</sup> anniversary of the Stockholm Water Prize and the World Water Week in Stockholm.

### Founders of the Stockholm Water Prize

The founders of the Stockholm Water Prize are Swedish and international companies in cooperation with the City of Stockholm. They are: Bacardi, Borealis & Borouge, DuPont, Europeiska Insurance, Fujitsu, General Motors, Grundfos Management, Hewlett Packard, ITT Water & Wastewater, Kemira Water, KPMG Sweden, Läckby Water, P&G, Ragn-Sells, Scandic, Scandinavian Airlines (SAS), Siemens AG, SJ (Swedish Railways), Snecma, Uponor, Water Environment Federation and Ålandsbanken Sverige.

# 2010 Stockholm Junior Water Prize

Youths from 30 countries had travelled to World Water Week in Stockholm to participate in the international finals of the Stockholm Junior Water Prize. The 2010 Prize went to Mr. Alexandre Allard and Mr. Danny Luong for their research on biodegradation of the plastic Polystyrene. The two Canadian students were presented with the prize by H.R.H. Crown Princess Victoria of Sweden at a ceremony on September 7.

“Every year more and more chemical debris is introduced in the environment and water bodies around the world. Research has shown these chemicals can release toxics into the water, they can be harmful for the environment, and deadly to life in water. Much of the debris in the world’s water ways are plastics which is used for fast food containers, disposable cups, and packing material for example. To date, there is no natural solution to safely take care of these harmful plastics. The winning project created a novel approach to break-down these plastics using micro-organisms and enzymes that are cost effective, and readily available. This method could greatly reduce the amount of plastics that end up in the world’s waters,” said the International Jury in its citation.

A Diploma of Excellence was given to Ms. Yingxin Li, Mr. Zhaonan Yang and Ms. Wanling Chen from China for their project “Novel Soil Remediation Technology for South China”. The international Jury said “their project neatly addresses the

theme of this year’s World Water Week: The water quality challenge. The team of dedicated students worked both in the field and in the laboratory for a long time. Their effort resulted in an exceptional report dealing with several crucial water quality-related problems including fertiliser loss, recycling of waste, and the improvement of soil fertility. The technique developed by the students holds great promise to help solve some of today’s most pressing problems within the agricultural sector.”

## About the Stockholm Junior Water Prize

The competition is open to young people between 15-20 years of age, who have conducted water-related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance. As a result of the competitions, thousands of young people around the world develop personal interests, undertake academic study, and often pursue careers in the water or environmental fields. H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize. The winner receives an award of USD 5,000 and a handmade blue crystal sculpture. The Stockholm International Water Institute administers the competition, which is sponsored globally by ITT Corporation. The official suppliers for the competition are Infobahn, Halebop, Hertz, People Travel Group and Trosa Tryckeri.



Photo: Exray

## 2010 Stockholm Industry Water Award



Photo: Exray

The 2010 Stockholm Industry Water Award was awarded to the Cambodian Phnom Penh Water Supply Authority (PPWSA) under the leadership of General Director Ek Sonn Chan. The PPWSA, which supplies water to the residents of the city of Phnom Penh, received the award in recognition of its world class performance in water supply and self-sufficiency.

When General Director Ek Sonn Chann was appointed in 1993, decades of conflict had left the city's water supply system in a poor state. Initiating an ambitious renovation programme, PPWSA has since managed to refurbish the whole supply system, introduce cost-effective billing and payment collection methods, as well as world class management to provide water to almost all of the city's residents.

"The PPWSA has successfully fought corruption and shown this can be achieved in a developing country on a large-scale basis using simple but effective management techniques that are based on well-accepted business principles and strategies. As a self-sufficient company, operating without subsidies from the state, PPWSA today provides 24-hour service and 90 per cent coverage to a city of 1.3 million and fully recovers its costs as it continues to develop both its infrastructure and management," said the International Award Jury in its citation.

The jury pointed out that though PPWSA was supported by international donors in its efforts to reach to where it is today, it

managed to become entirely self-sustainable as it benchmarked itself against the best operators in both developing and developed nations. PPWSA's work has contributed to visible improvements in public health and a reduction of constraints to industrial, social and economic developments in Cambodia's capital.

Accepting the award on behalf of PPWSA, Mr. Ek Sonn Chan said the Stockholm Industry Water Award puts his organisation in the same league as other world class water industry organisations, reinforcing their drive towards achieving future objectives.

### **About the Stockholm Industry Water Award**

The Stockholm Industry Water Award recognises the business sector's contribution to sustainable water management, by minimising water consumption and environmental impact. It is given to any sector of business and industry. It recognises improved performance in production processes, new products, and management, as well as innovative approaches in water and wastewater process technologies which together help to improve the world water situation. The Award was established in 2000 by the Stockholm Water Foundation in collaboration with the Royal Swedish Academy of Engineering Sciences and the World Business Council for Sustainable Development and is administered by Stockholm International Water Institute (SIWI).

# 2010 Swedish Baltic Sea Water Award

The 2010 Swedish Baltic Sea Water Award was given to Prof. Maciej Nowicki and Prof. Marek Gromiec, two Polish professors whose careers have contributed to improving the marine environment of the Baltic Sea. In its official motivation, the award committee pointed out that Prof. Maciej Nowicki and Prof. Marek Gromiec have managed to link science, management and politics in successful programmes for reducing the Polish nutrient loads to the Baltic Sea.

Nutrients from wastewater and agricultural activities have a strong negative impact on the water quality of the Baltic Sea. During the last decade, Poland has made considerable investments in new and modernised sewage treatment, which has led to a significant decrease in the concentration of nutrients being transported to the Baltic Sea. The two winners of the Swedish Baltic Sea Water Award have both contributed to this positive development.

Professor Maciej Nowicki is the founder of EcoFund, an independent non-profit institution which channels foreign financial resources into environmental protection projects in Poland. Since its establishment in 1992, EcoFund has subsidised

initiatives of both national and international significance. Prof. Nowicki served as Eco Fund's president until 2007.

Professor Marek Gromiec has led a number of national and international projects on water management which has led to the development of a national water policy and pollution control strategies. As the Chairman of the Polish National Council for Water Management, he has significantly contributed to reduction of Poland's pollution into the Baltic Sea.

Prof. Maciej Nowicki and Prof. Marek Gromiec received the award from Mr. Joakim Stymne, State Secretary for International Development Cooperation, Sweden's Ministry for Foreign Affairs, at a special Baltic Sea seminar on September 7.

## About the Swedish Baltic Sea Water Award

Established in 1999, the Swedish Baltic Sea Water Award honours innovation, commitment and new methods that help protect the Baltic Sea water environment. The Award is presented annually by Sweden's Ministry for Foreign Affairs and is administrated by the Stockholm International Water Institute (SIWI). The prize sum was increased this year from 100,000 SEK to 250,000 SEK.

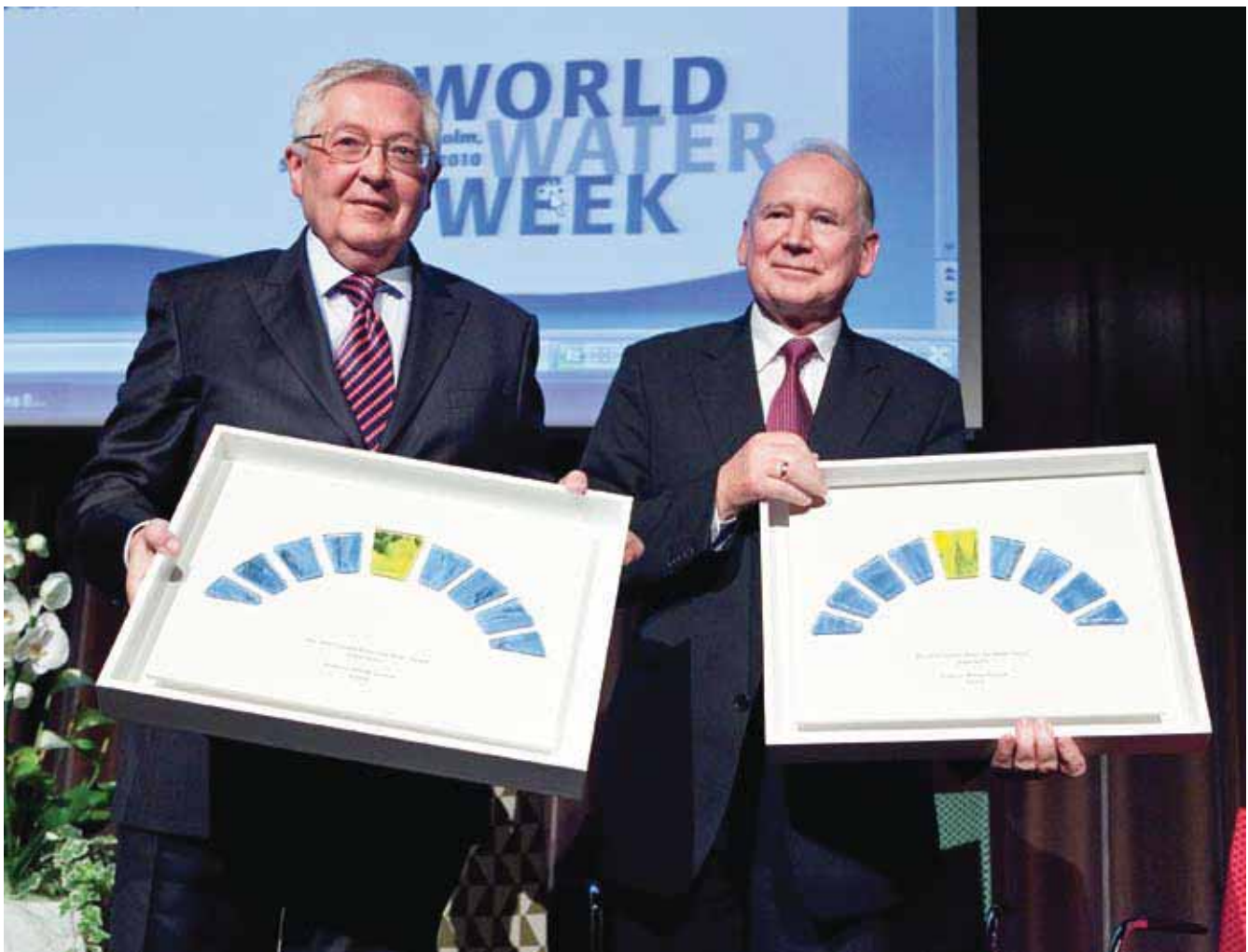


Photo: Mikael Ullén/SIWI

## 2010 Best Poster Award

Mr. John Feighery, a PhD Candidate in Earth and Environmental Engineering at Columbia University, received the Best Poster Award at the 2010 World Water Week. He won the award for his presentation of “Microbial Contamination of Shallow Tube Wells in Bangladesh: Evaluation of Potential Pathways and Implications for Sanitation Planning”.

Having monitored over 100 shallow tube wells in rural Bangladesh each month for over a year, Mr. Feighery found that in this area between 30 and 70 per cent of wells test positive for *E. coli*, an indicator for fecal contamination. This finding, combined with observations of the sanitation and water infrastructure, raise important questions about the safety and

sustainability of shallow groundwater resources, even in an area displaying a high level of access to improved sanitation.

Groundwater is often considered to be microbiologically safe, and approximately two billion people globally depend on groundwater for their drinking water.

### About the World Water Week posters

The posters displayed at World Water Week follow the same themes as the workshops organised during the Week. The poster authors are available to discuss their work during two Poster Sessions. The Best Poster Award is presented during the Closing Plenary Session.

## 2010 WASH Media Award

At a special media seminar on September 9, seven journalists were rewarded with the WASH Media Award for their excellence in reporting on water and sanitation related issues. The journalists were:

- Ms. Teresa Rehman, freelance, India, “Sanitation in the time of floods”, English category
- Mr. David Onofre González Travieso, *Diario el Nacional*, Venezuela, “Una sequía de obras”, Spanish category
- Mr. Arsénio Basílio Manhice, *Jornal Notícias*, Mozambique, “Stress hídrico’ abala mulheres e crianças”, Portuguese category
- Mr. François Koami Amégnignon, *Radio Zéphyr*, Togo, “Etat des lieux de l’eau l’hygiène et l’assainissement au Togo”, French category
- Ms. Natalia Silitskaia and Mr. Oleg Banaru, freelance, Moldova, “Damocles Sword above the Moldavian Komarovo”, Russian category

- Ms. Juana Salamanca, freelance, Colombia, “Los ángeles guardianes de los humedales”, Gender category
- Ms. Nina Stenros and Ms. Anu Valve, Finnish Broadcasting Company YLE, Finland, “Shit happens 1/4”, High-income country category.

The WASH Media Award initiative recognises and supports the crucial role of the media in raising awareness of the importance of water, sanitation and hygiene services. It aims to help improve access to these services by having a positive influence on politicians, business persons, civil society representatives and individual citizens.

The bi-annual award is sponsored by the Water Supply and Sanitation Collaborative Council (WSSCC) and the Stockholm International Water Institute (SIWI).



Photo: Mikael Ullén/SIWI



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# Overarching Conclusions

## World Water Week in Stockholm

### Building Capacity – Promoting Partnership – Reviewing Implementation

The World Water Week in Stockholm, organised by the Stockholm International Water Institute, is the leading annual global meeting place for capacity-building, partnership-building and follow-up on the implementation of international processes and programmes in water and development. It includes topical plenary sessions and panel debates, scientific workshops, independently organised seminars and side events, exhibitions and festive prize ceremonies honouring excellence in the water field. Stockholm is the meeting place for experts from businesses, governments, the water management and science sectors, inter-governmental organisations, non-governmental organisations, research and training institutions and United Nations agencies.



[www.worldwaterweek.org](http://www.worldwaterweek.org) • [www.siji.org](http://www.siji.org)



STOCKHOLM INTERNATIONAL WATER INSTITUTE, SIWI  
DROTTNINGGATAN 33, SE-111 51 STOCKHOLM, SWEDEN  
PHONE +46 8 522 139 60 + FAX +46 8 522 139 61 + [siji@siji.org](mailto:siji@siji.org) + [www.siji.org](http://www.siji.org)

[www.worldwaterweek.org](http://www.worldwaterweek.org)