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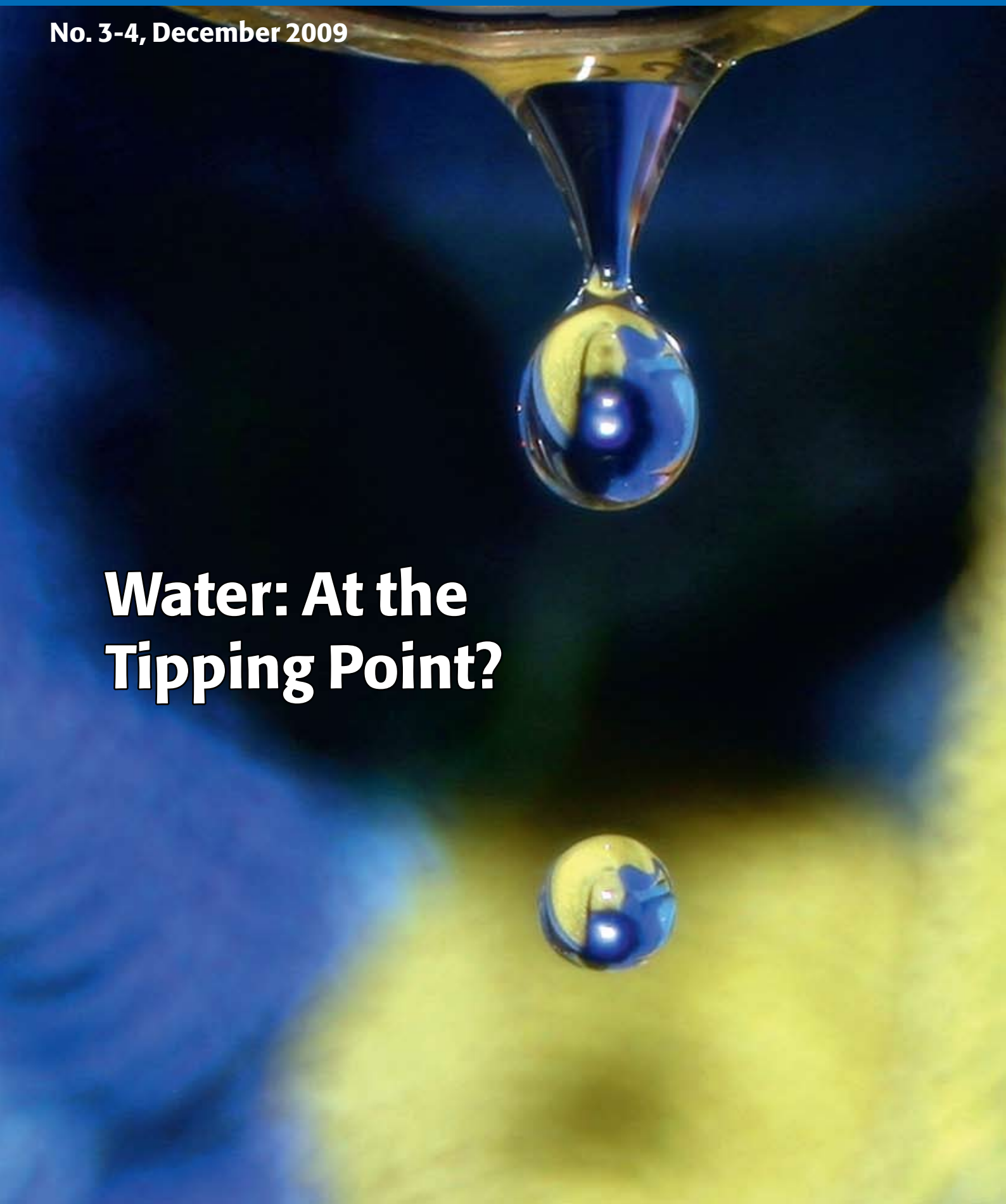


Water: At the Tipping Point?

Pushing the Limits

Photo: Thomas Henriksson/SIWI

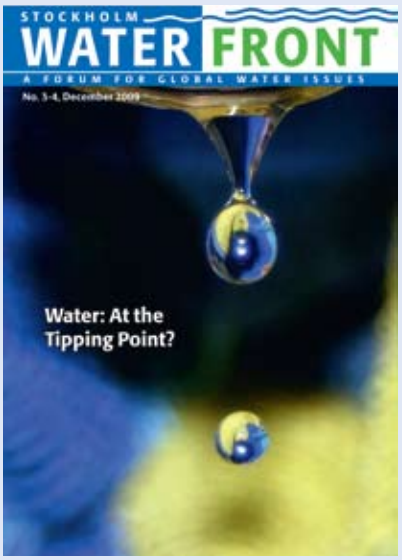
The potential for human ingenuity is boundless. But our planet has limits. The latest research provided in this issue of Stockholm Water Front investigates the initial findings for a "planetary boundary" for water use. Prof. Will Steffen estimates that a safe global boundary for consumptive blue water use is approximately 4,000 cubic kilometers per year. Current annual extraction is already 3,000 cubic kilometers. By nature, these estimates are not exact. We cannot accurately assess when the "tipping point" for large-scale environmental change will be crossed, but we do know that the changes can come abruptly if they are. As water withdrawals are predicted to increase by 50 percent by 2025 in developing countries, and 18 percent in developed countries, we may be heading into dangerous territory.

As the global population expands by the billions, our collective capacity for creative solutions to respond to global change grows with scores of brilliant new minds that join the work force every day. Our ambitions must run high. Eighteen year old Stockholm Junior Water Prize winner Ceren Burçak Dag from Turkey provides answers and inspiration with her breakthrough in clean energy development from falling rain. She envisions a future energised by combined solar, rain, and wind powered panels; a future she will help create.

As Dr. Tim Jones explains, innovation and investment to improve efficiency in water use has become core business for CEOs, which means more of those minds are being applied to the task of reducing water footprints. This is good news, because as Prof. Luis de la Cungha explains, a secure fix to the recent recession will require that addressing the water crisis becomes a global priority. But the rapid advancement of improved technologies and process must be matched by an equally impressive deployment of new knowledge and the mechanisms to enact it.

Climate change only adds to the challenge as we expect a wetter, drier, and less predictable future with more droughts, floods and rising seas. The discussions in Copenhagen for the COP-15 must come forth with a path to accelerate our mitigation of greenhouse gases and the capacity of nations to adapt to the impacts of climate change. The message from the participants of the 2009 World Water Week in Stockholm came in loud and clear (see page 8): water management is the centre of climate adaptation, and must be included in the agreement. In this issue, you can also read more on the discussions, outcomes and highlights from the 2009 Week. For complete coverage of the 2009 World Water Week in Stockholm, please visit www.worldwaterweek.org to find a year round resource bank on water knowledge, including the 2009 Overarching Conclusions, presentations, reports, video interviews, podcasts and much more.

Anders Berntell
Executive Director
Stockholm International Water Institute



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Putting Water at the Centre

More than 2,400 participants from 135 countries gathered in the Swedish capital for the 2009 World Water Week in Stockholm, August 16-22, and an exciting series of plenary sessions, workshops, seminars and side events. The week, hosted for the 19th time by the Stockholm International Water Institute (SIWI), featured more than 165 collaborating organisations.

A record number of participants in Stockholm met to bolster their ongoing work to find constructive solutions to the planet's water crisis. One billion people are without access to safe drinking water, 2.4 billion are without adequate sanitation and growing, richer populations mount pressure on limited water resources. With the overarching theme of "Responding to Global Changes – Accessing Water for the Common Good," the World Water Week linked approaches, solutions, policies, mechanisms and financial options that can lead the way to sustainable demand management and allocation strategies amidst increasing competition between water uses.

SIWI Executive Director Anders Berntell opened the week with a clear call to shift global priorities. "We can provide astronauts with a safe supply of drinking water and a toilet when they travel to the moon, but we cannot provide the same service to people living in the slums of Kibera, Nairobi or Dharavi, Mumbai." Poor access to water and sanitation impairs the functioning of any society, he stressed, while smart distribution of water and access to safe sanitation is an integral part of social and economic development.

Citing that over 60 percent of the global population living in shared river basins, Hon. Gunilla Carlsson, Minister for International Development, Sweden applauded the Week´s Special Focus on Transboundary Waters. She described the opportunities to improve benefit sharing from transboundary waters as "something we cannot ignore" and stressed that the challenges faced go beyond basins, borders and land, ""Eutrophication of our seas, needs solutions on land. And dumping sewage from ships into the seas, requires binding international anti-dumping laws. The common denominators are joint solutions and global agreements."

Jan Eliasson, Chair of WaterAid Sweden and former President of the United Nations General Assembly, expanded on the theme.

Photo: Thomas Henrikson/SIWI

"The link between water management, growth and poverty reduction is obvious", said Hon. Gunilla Carlsson, Swedish Minister for International Development Cooperation. "By increasing access to water we can change the lives and health of poor women, men and children for the better."

Photo: Thomas Henrikson/SIWI

"People started laughing when we suggested making toilets available in all important public places," said Dr. Bindeshwar Pathak, the 2009 Stockholm Water Prize Laureate Lecture during the opening plenary. "Now we have installed more than 7,500."

"Water and sanitation must be given a higher priority by governments, by nations, in the municipalities, in the countries where the problems are," he said. "We need to move from fact finding and early warning to fact facing and early action."

The 2009 Stockholm Water Prize Laureate Dr. Bindeshwar Pathak reminded those at the Plenary that there is tremendous work being done on the ground, some of it through his own Sulabh Sanitation movement in India. "People started laughing when we suggested making toilets available in all important public places," he said. "Now we have installed more than 7,500."

Transboundary waters in focus

Following the Opening Plenary session, a high level panel of experts addressed the complexities of politics and power in shared

The High Level Panel on Transboundary Waters, moderated by Dr. Letitia A. Obeng (far left), Chair, Global Water Partnership, gathered leading experts and policy makers in the field for a spirited discussion on shared waters.

water basins, which set the tone for the over 20 sessions on Transboundary Waters held throughout the week. The panel noted how the complex situations that tend to divide nations who share watercourses do not necessarily have to be stumbling blocks to solving water issues. Joint management of water is not a zero sum game, it is a positive sum game. More food, less flood damage, and more hydropower can all be created by cooperative and smart policy. However, the unique conditions of each basin require creative thinking. Hon. Rejoyce Mabudafhasi, deputy minister from South Africa emphasised: "Transboundary river basins are inherently political and economic. Thus there cannot be one-size fits-all solutions."

Regional perspectives

For the first time, the 2009 World Water Week featured a focus on *Latin America*. The integrated day of events, convened by the Inter-American Development Bank (IDB), United Nations Human Settlements Programme (UN-HABITAT), FEMSA Foundation, Water Center for Latin America and the Caribbean (CAALCA) and others, addressed the prospects and challenges in multistakeholder collaboration, integrated land and water management and sustainable water tariffs throughout the region. The Asian Development Bank and a host of co-convening organisations led the *Focus: Eye on Asia*, which discussed wide-ranging issues of urban water supplies and sanitation, climate change, river basin management and water security across the continent. A number of events throughout the week dissected the current state of water-related issues in Africa along with efforts to build resilience to climate change and accelerate progress on the Millennium Development Goals across the continent.

Key messages to take home

Sustainable solutions to balance the competing demands from growing cities, populations and diets and to provide adequate and clean water for agriculture, human use and ecosystems, will require innovative but grounded approaches and improved systems thinking. For example the earth will need to feed 2.5 billion more people within the next 30-40 years, and there will be less water available for agriculture. Many asserted that a price that reflects its scarcity value should be put on water and coupled with land tenure reforms that can make farming more productive and profitable. In all water basins, and in particular those that cross national borders, more resilient and flexible management structures, laws, institutions, and policies are needed.

The two day-long *Focus: Water and Climate sessions* made clear that the impacts of climate change will be felt primarily through changes in the hydrological cycle. To cope with the increasingly variable supply of water created by climate change, current and future investments should put specific focus on enabling adaptation in order to enhance water security. As Anders Berntell noted, "The mandate before our world is to prevent the avoidable and adapt to the unavoidable." Most of the elements of good adaptation practice, such as Integrated Water Resource Management (IWRM) are already known but they must incorporated and implemented in policy and planning.

Outcomes and conclusions

The official 2009 World Water Week Conclusions is now available at www.worldwaterweek.org. The document represents the World Water Week's broader global water and development contribution. It contains Overarching Conclusions from SIWI, as well as special reports on five thematic areas produced by specially appointed World Water Week Rapporteur Teams on 1) Managing water across borders, 2) Coping with climate change, 3) Balancing competing demands, 4) Responding to socio-economic and demographic changes, and 5) Ensuring human and environmental health. Brief event summaries from the workshop, seminar and side events are all available at www.worldwaterweek.org. There you can also find most presentations and speeches from the Week's events in addition to conclusions and reports from the various sessions. In early 2010, the "Best of the World Water Week 2009" will showcase a selection of essays that present new and novel findings that emerged at the Week from the leading voices in the field.

2010 World Water Week celebrates 20 years September 5-11

Since 1991, when it was known as the "Stockholm Water Symposium", the World Water Week in Stockholm has been the leading annual meeting place in water and development. Mark your calendar for September 5-11 2010,

Photo: Thomas Henrikson/SIWI

and join us for the 20th anniversary of the World Water Week and the Stockholm Water Prize. The theme for the event is "The Water Quality Challenge – Prevention, Wise Use and Abatement." In addition to the special focus on Water Quality, the cross-cutting issues in water, food, finance, sanitation, climate and development will once again be on the agenda. To learn more, please find the First Announcement and Call for Workshop Abstracts and Seminar Proposals, as well as more information at www.worldwaterweek.org.

www.worldwaterweek.org : Your year round information centre

The World Water Week is more than a conference. It is a living library of water knowledge. For two decades, our seminar and workshop organisers have brought together the top experts in a wide-array of water and development issues. Beyond the hundreds of presentations made during the week, you can find a host of video interviews, audio podcasts as well as scientific papers and abstracts. It is all easy to navigate through the same search system that powers the popular "event finder" function, where you can search by event, name or keyword.

2009 Supporters and Sponsors

Swedish International Development Co-operation Agency, Swedish Ministry for Foreign Affairs, the City of Stockholm, German Federal Ministry for Economic Cooperation and Development, Stockholm Water Company, Nestlé, Black and Veatch, Fundación Femsa and Sweco.

Voices from World Water Week 2009

Why are you attending World Water Week?

"Tamil Nadu does not have a lot of water resources which means it depends on the water supply of neighbouring states which in turn causes conflicts. This strongly relates to the special focus of the conference Transboundary Waters."

Marimuthu Kuzhali, Water Resources Organisation, Government of Tamil Nadu, India

"I am working in the Environment Protection Unit, and my aim is to become a specialist within the area of water issues. I am here to learn more about this field."

Lozika Masic, Croatian Chamber of Economy, Industry and Technology Department, Croatia

Would a human rights approach to water and sanitation help improve the world water crisis?

"If governments could ratify and accept that water is a human right, it would help to better target the people that really need help. Additionally, if access to water is made a human right, there would be legal backing in targeting the poor."

Otieno Pireh, UN-HABITAT, Kenya

"Yes, but not without a shift from the current emphasis on financial interests and self-interests. There is an aspiration towards improvement without a willingness to change own practices. It's a great ideal, but hard to achieve."

Jane Gibbs, Umwelt Pty Limited, Australia

How is climate change impacting your region? What can be and what is being done?

"There has been a drastic change in the rain pattern distribution in the wettest region of the world: the North Eastern Hills of India. The people themselves are trying to adapt to the situation, however, none of the methods are sustainable. Since deforestation is the major cause of climate change in this area, afforestation is the main solution."

Om Prakash Singh, Climate Change & Water – Human Dimensions, Sweden

"The last 50 years have seen an increase in humidity. We know some ways of solving the problems of climate change, but since Kyrgyzstan is a developing country there are financial problems. A good solution is the water purification in the Aral Sea that is driven by solar power."

Ilimidin Abdurasulov, Institute of Research, Kyrgyzstan

What is the key message that you will take home from the 2009 World Water Week?

"How to combat the problem of sanitation in poor urban and rural areas. So far we have only looked at one technique of handling the problem, however, here at the World Water Week we have looked at different techniques that are more sustainable and safe. This is needed in order to achieve the Millennium Development Goals of sanitation."

Mutaekulwa Mutegeki, Energy and Water Regulatory, Tanzania

"One key point is the issue of financing. There is no country with full recovery in the water and sanitation sector. Taking the latter into account one can take a different view of tariffs, subsidies, transfers and the mobilising of private finance. The challenge is to improve the mix of financing sources. "

Pierre Guillibert, German Technical Cooperation (GTZ), Germany

Photo: Mikael Ullén/SIWI

World Water Week Makes a Clear Statement on Climate and Water

In the fields of water and climate, consensus is often hard to come by, and especially so when the group is as large and diverse as the 2400 participants from 135 countries at the 2009 World Water Week in Stockholm. Yet, at the final plenary of the Week on August 21, arms energetically shot up from every filled seat to vote for the idea that water must be included in the COP-15 climate agreement in Copenhagen this December. This was a result of a consensus building processes throughout 2009 and during the World Water Week Climate sessions.

The assembled participants of World Water Week reached more than consensus on the matter. They made a unanimous and unambiguous vote for "The Stockhom Message from the World Water Week to the COP-15". Months of activity, including the Dialogue on Climate Change Adaptation for Land and Water Management, the 5th World Water Forum in Istanbul and dialogues held at the Climate Change Negotiations in Bonn formed the basis of the the Message´s content. A growing number of organisations and opinion leaders have gone public with commentary in support of The Stockholm Message, which has been pushed forward together with the UN-Water Key Messages on Water and Climate, notably at 'Water Day' during the Barcelona Climate Talks in November.

But this is only a beginning. How can we make sure that the indisputable connections between water and climate change become a top priority, even if they are not formally on the agenda in Copenhagen?

The full formal text of The Stockholm Message is published here as an invitation for readers to send us their thoughts on the issue. Please send your comments to Karin Lexén, SIWI, karin.lexen@siwi.org

Voices in support of the message

Mr. Anders Berntell, SIWI: "We know that water is the medium through which climate change manifests its most serious effects. To be effective, climate negotiations must factor in the impact and importance of water for the world and, indeed, human well-being."

Dr. Ger Bergkamp, World Water Council: "Water is key to development and the first medium through which climate change will be felt. Therefore, the global agreement that will follow the Kyoto Protocol must have clear targets and strategies for prioritising water in the adaptation to climate change."

Dr. John Matthews, WWF: "Especially with water – which is how most people will feel the impacts of climate change – we have to make climate change adaptation work. All WWF's experience says that adaptation works best when it is ecosystem based."

Dr. Henk van Schaik, Cooperative Programme on Water and Climate: "Adaptation to climate change in the water sector is crucial for sustainable development. Both climate and water experts should join forces building a framework for improved support to societal needs – beyond the COP-15 in Copenhagen."

The Stockholm Message from World Water Week to the COP-15

Introduction

Climate change is happening and adding complexity to existing global challenges. A strong and fair agreement on future global commitments on climate change measures – both mitigation and adaptation – is crucial in order to secure future water resource availability. The negotiations towards a Copenhagen Agreement are therefore of great concern to the global water community.

The importance of water must be properly and adequately reflected within the COP-15 agreement, and in processes beyond COP-15. In recent months substantial efforts have been undertaken to ensure that this is achieved including the Dialogue on Climate Change Adaptation for Land and Water Management, the 5th World Water Forum in Istanbul and during dialogues held at the Climate Change Negotiations. Reflecting these efforts, and the urgent need to ensure that the global community is adequately prepared to respond to climate change, the following messages are conveyed from Stockholm to Copenhagen:

- Water is a key medium through which climate change impacts will be felt. Managing the resource effectively, including through well-conceived IWRM approaches and at a transboundary level, is central to successful adaptation planning and implementation, and to building the resilience of communities, countries and regions;
- Adaptation is a prerequisite for sustainable development and poverty reduction. Adaptation measures thus need proper integration within broader development goals and objectives, including the Millennium Development Goals;
- Integration of water with land and forest management is key to effective adaptation. We strongly endorse the Nairobi Statement on Integrated Land and Water Resources Management for Climate Change Adaptation; we also emphasise that water-related adaptation can and should support global mitigation actions;
- Ecosystem protection and sustainability is fundamental to adaptation and human development. We therefore urge increased efforts towards and investment in the protection and restoration of natural resources – including water – as an essential part of any adaptation process;
- Higher-quality information that is more effectively shared will strengthen responses. In particular there is a critical need for the water and climate communities to increase the sharing of information at all levels of policy and practice – from global to local, and from local to global;
- Vulnerability assessments and risk management are critical to sound adaptation practice. Knowing where and how the impacts of climate change are most likely to affect populations and ecosystems through the water cycle will help in the identification of areas for early intervention or 'hot spots'; these include arid regions, areas highly dependent on groundwater, small island developing states, low-lying deltas and fragile mountainous areas;
- New and additional funds are essential. It is imperative that additional funding is allocated in support of developing adaptive strategies for vulnerable groups and ecosystems; there is a need for an initial mobilisation of finance to assist vulnerable, low income countries already affected by climate change, followed by the establishment of a well-resourced mechanism for funding adaptation as part of ongoing climate negotiations.

Follow up

We urge the global water and climate communities to look beyond COP-15 and work through dialogue to strengthen global mechanisms that can enhance collective action on water and adaptation. These should include, but not be limited to, better sharing of knowledge and technology in support of adaptation measures in developing countries, active support for capacity building and access to improved levels of financing.

Finally, the water community expresses its commitment to strengthening institutional cooperation at all levels between the climate, water and wider development communities under appropriate mechanisms and institutional arrangements in order to work more collectively to address the immense development challenges ahead.

Photo: Neil Chatterjee

Highlights from World Water Week

Photo: Exrey

Dr. Bindeshwar Pathak and H.R.H Prince Carl Philip.

Dr. Pathak honoured with Stockholm Water Prize

Dr. Bindeshwar Pathak, founder of the Sulabh Sanitation Movement, received the 2009 Stockholm Water Prize from the hands of H.R.H Prince Carl Philip of Sweden for his work to improve the health, dignity and well-being of millions of people.

UV pioneers shine in Stockholm

Peter Forssman, Chair, Stockholm Water Foundation handed the 2009 Stockholm Industry Water Award (SIWA) to Marvin DeVries, President Trojan Technologies, Canada, at an award ceremony. Based in Ontario, Canada, Trojan produces UV disinfection systems for industrial applications, municipal water and wastewater treatment, commercial integration, residential use, and elimination of environmental contaminants from wells and other sources of drinking water, including reused water. With installed systems at more than 5,800 facilities in more than 80 countries, Trojan has led the worldwide drive for commercial, engineering, and regulatory acceptance of the technology as an environmentally sound alternative to traditional chlorine-based water treatment.

Photo: Thomas Henrikson/SIWI

The Stockholm World Water Cube in action!

World Water Cube live from Stockholm

The 2009 World Water Week in Stockholm was the first water conference to do event-based online video with the debut of the Stockholm World Water Cube. The joint project between SIWI, IRC International Water and Sanitation Centre and Akvo.org invited participants to share ideas and interactions with a dynamic, independent, constantly changing team of video reporters, drawn from some of the water sector's most innovative organisations. Check out www.watercube.tv channel to experience the fun and power of online video.

Photo: Mikael Ullén/SIWI

Ms. Catarina de Albuquerque.

Independent expert on Human Rights to Water and Sanitation

The UN Independent Expert on the obligations related to access to safe drinking water and sanitation, Catarina de Albuquerque presented her conclusions from her first year in the post at the World Water Week in Stockholm. She emphasised that from a human rights perspective, it does not matter whether services are public or private, as long as everyone's right to access is fulfilled. Just as is the case with other human rights, such as food and education, people who can afford to are often required to pay. However, states must work to make prices that are affordable for all. Critically, there must be systems in place to make sure that those who cannot afford water and improved sanitation are not deprived of their basic needs.

Photo: Mikael Ullén/SIWI

Mr. Björn Stigson.

Government, business leaders reflect at closing

Mr. Björn Stigson, President, World Business Council for Sustainable Development, Mr. Bai-Mass Taal, Executive Secretary African Minister Council on Water, and Hon. Pawan Kumar Bansal, Minister of Water Resources, India, gave personal insights on the findings of the Week and key challenges for the future at the closing plenary.

Middle East leaders meet on water and climate

The United Nations Development Program hosted a meeting of senior representatives from over 10 countries in the Middle East to discuss the impacts of Climate Change and development of adaptation strategies in the region. Senior UNDP officials and experts, Mr. Paolo Lembo, Director of UNDP-Iraq and Mr. Hosny Khordagui, Director of UNDP's Water Governance Program in the Arab States discussed the increasing body of research highlighting the severe impacts on water resources expected in the region and the need for more to be done to prepare for them.

Photo: Dan Shirley/SXC

The Power of Rain

Ceren Burçak Dag had a rough start to World Water Week when her luggage got lost in transit from her home in Turkey. What happened later in the Week more than made up for it.

At an award ceremony on August 18, the young woman from the Nişantaşı quarter of Istanbul was named winner of the 2009 Stockholm Junior Water Prize. She won the coveted honour with her study detailing an innovative method for generating energy from falling rain drops.

"Many young people are concerned about climate change, but few will take action to identify a solution," noted the Stockholm Junior Water Prize Jury in its citation. "Reducing CO^2 emissions by developing alternative environment-friendly, renewable energy sources is a specific response to this global problem. This year's winner had a spark of genius in developing a high tech solution that used PVDF, a smart material with piezoelectric properties, to transfer the kinetic energy of raindrops into electrical energy."

Ceren Burçak Dag competed with other high-school age students from 29 countries for this year's prize. The international field encompassed more than 5,600 individual projects. After the ceremony, she explained her hopes for her award-winning project. "We have a new energy source from rain with a piezoelectric effect with this project," she said. "I hope that my work will contribute to the development of the next generation of energy panels where rain, sun, and wind are combined."

The Stockholm Junior Water Prize jury also awarded Diplomas of Excellence to Emily Elhacham of Israel for her project, "Detecting water contamination chemical sensors using metal nanoparticle networks", and Mary Zhao of Canada, for her project, "Grasping water: A novel method of inducing precipitation using the Ice Nucleating Protein".

About the Stockholm Junior Water Prize

The international Stockholm Junior Water Prize competition brings together students to encourage their continued interest in water and the environment. Each year, thousands of participants in over 30 countries join national competitions for the chance to represent their nation at the international finale held during the World Water Week in Stockholm. The national and international competitions are open to young people between the age of 15 and 20 who have conducted water-related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance.

The winner receives a USD 5,000 award and a crystal sculpture. H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize. The Stockholm International Water Institute administers the prize. ITT Corporation is the global sponsor of the award.

Photo: Exray

Ceren Burçak Dag receives the prize from Mr. Peter Forssman, Chairman of the Stockholm Water Foundation at the award ceremony.

Tipping Elements, Planetary Boundaries and Water

The human imprint on the hydrological cycle is now apparent on a global scale. About 40 percent of the total global runoff ("blue water") is now intercepted by large dams and impounded before it flows to the oceans. In many parts of the world, extraction of water from river systems has become so complete that about 25 percent of the world's rivers run dry before they reach the ocean. In other parts of the world, such as the central United States and the Chad Basin in Nigeria, extraction of groundwater is occurring at rates much higher than recharge flows, leading to the eventual depletion of the resource.

Humans have also modified water vapour flows ("green water") from the land to the atmosphere through deforestation and irrigation. Although the net change in vapour flow at the global scale is very small, large regional and seasonal changes have occurred.

A global perspective on human water use

Our growing understanding of the functioning of the Earth System is leading to new insights into the implications of human modification of the global environment. One of the most dramatic features in the Earth System functions is the threshold/abrupt change behaviour associated with "tipping elements" (Figure 1). Tipping elements are defined as sub-systems of the Earth System for which a small change in a forcing factor can trigger an unexpectedly rapid and large response in the system.

The hydrological cycle is involved in several of the tipping elements identified so far. In some cases, human perturbation of the hydrological cycle through modification of blue or green water flows could trigger an abrupt or irreversible change in a tipping element. In other cases, other human pressures on the environment could trigger changes in a tipping element that could have serious consequences for water resources for humans.

A well-known example of a tipping element is the Amazon rainforest, where ongoing conversion of rainforest to cropland or pasture could cause a threshold to be crossed, leading to a rapid, irreversible conversion of the rainforest to a semi-arid savanna. This is a case of human modification of water vapour – or green water – flows through a change in land cover. The reduction in green water flows, which are a critical component of the regional rainfall regime through recycling of water between forest and regional atmosphere, could reach a critical point beyond which the drying forests become more vulnerable to wildfires, triggering the rapid conversion to more arid ecosystems.

An example of a tipping element that could have serious consequences for water resources for a large number of humans is the potential shift in the Asian Monsoon to a drier state. In this case, an indirect human effect – the regional emissions of aerosols – is the trigger for a potentially abrupt shift in monsoon behaviour. A critical change in the regional albedo (ability to reflect incoming solar radiation) could trigger a shift in the monsoon to a drier state, a shift that could occur in only a year or two. Given that over one billion people are reliant on the wet state of the Asian Monsoon for the water required to produce their food, a sudden switch of the system to a drier state would likely be catastrophic, leading to a significant reduction of available water and a consequent drop in food production. In effect, a shift in the state of the Asian Monsoon would reduce the human carrying capacity of the Indian subcontinent.

The implications of tipping elements for global governance are profound. Recently a new conceptual framework – "planetary boundaries" – has been proposed to guide humanity in dealing with the threats caused by its own modification of Earth System functioning. The goal is to avoid crossing critical thresholds that would trigger abrupt or irreversible environmental changes, which, in turn, would be deleterious for human well-being. In essence, a collection of appropriately positioned planetary boundaries would define a "safe operating space" for the human enterprise to continue to evolve and develop.

Figure 2 presents the conceptual framework for planetary boundaries. For each boundary – whether it relates to a sub-system that can undergo threshold-abrupt change behaviour or whether it is a slow variable that undermines resilience – we identify a control variable. The next step is to identify a boundary along that control variable that humanity should not transgress. Ultimately, the question is a normative one – how much risk is humanity willing to take in approaching, and perhaps inadvertently crossing, one of the thresholds?

"One of the most dramatic features in the Earth System functions is the abrupt change behaviour associated with "tipping elements", where a small change in a forcing factor can trigger an unexpectedly rapid and large response in the system."

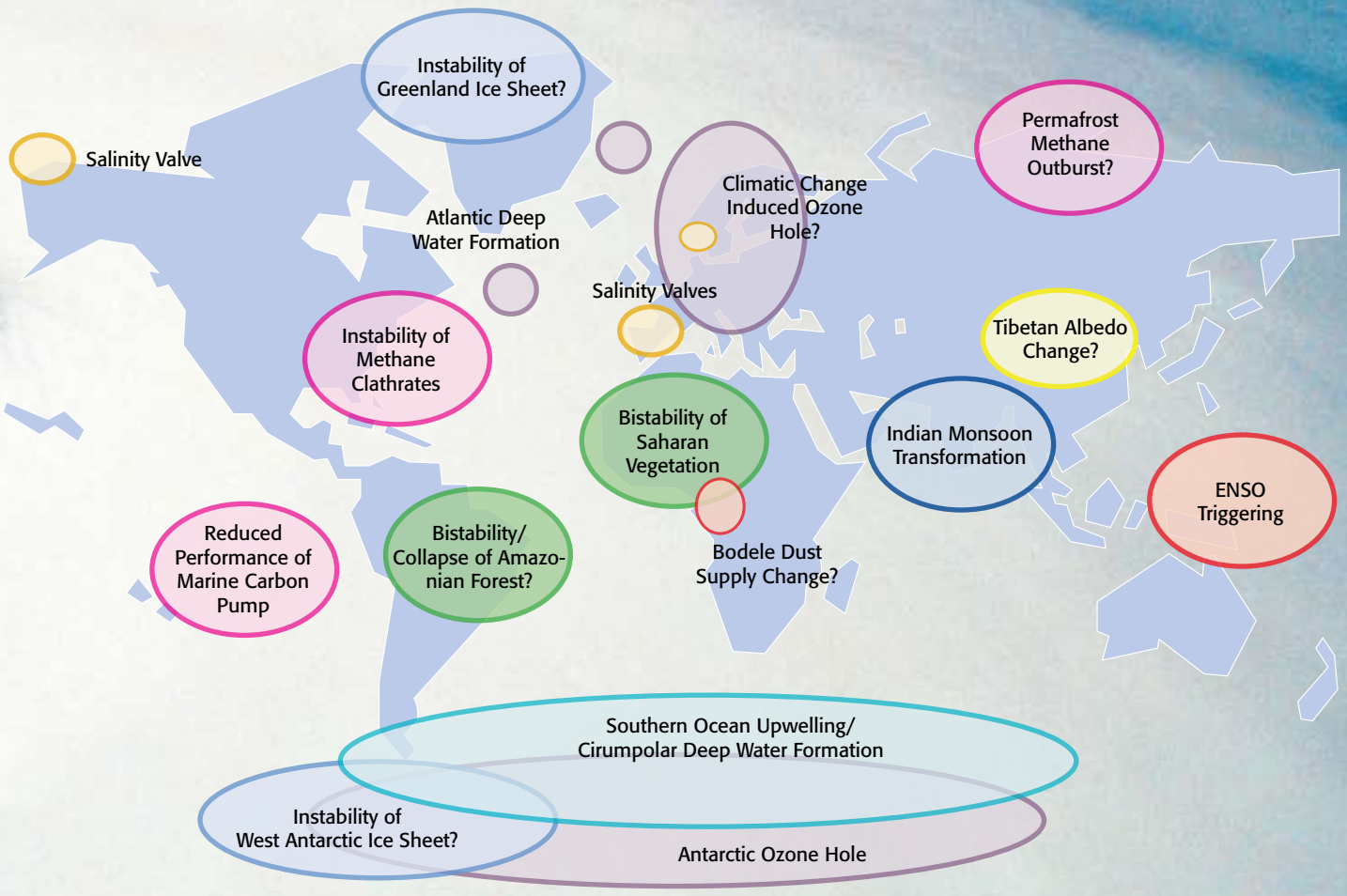

Figure 1. Tipping elements in the Earth System. Subsystems shown could exhibit threshold-type behaviour in response to human forcing, where a small perturbation at a critical point qualitatively alters the future fate of the system (after Lenton et al. 2008).

The initial analysis has identified nine planetary boundaries, one of which is water. The water boundary is perhaps the most complex of the nine, as it acts both as a slow variable that can undermine the resilience of, for example, the climate system, but can itself also show threshold/abrupt change behaviour at the regional scale. The Amazon Basin case cited above is an example of the latter.

Even selecting a control variable for the water system has been difficult. In the end, we have chosen the amount of blue water co-opted for human use as the control variable, hoping to capture modification of green water flows as an "upstream consequence" of blue water use. Blue water use contributes vapour flow to the atmosphere, later to generate precipitation. But it also depletes river flow, alters the mixing between freshwater and oceans and threatens ecosystems. With this approach, a boundary of about 4,000 km^3 yr^{-1} of consumptive blue water use has been suggested. This compares to a current level of blue water use of 3,000 km^3 yr^{-1}, an estimation of 5,000-6,000 km^3 yr^{-1} for the onset of physical water scarcity and an upper limit of accessible blue water resources of 12,000-15,000 km^3 yr^{-1}.

Transgressing the boundary for global freshwater use could lead to the crossing of water-related thresholds, such as the collapse of freshwater ecosystems or the collapse of regional lake systems (e.g., the Aral Sea). At the

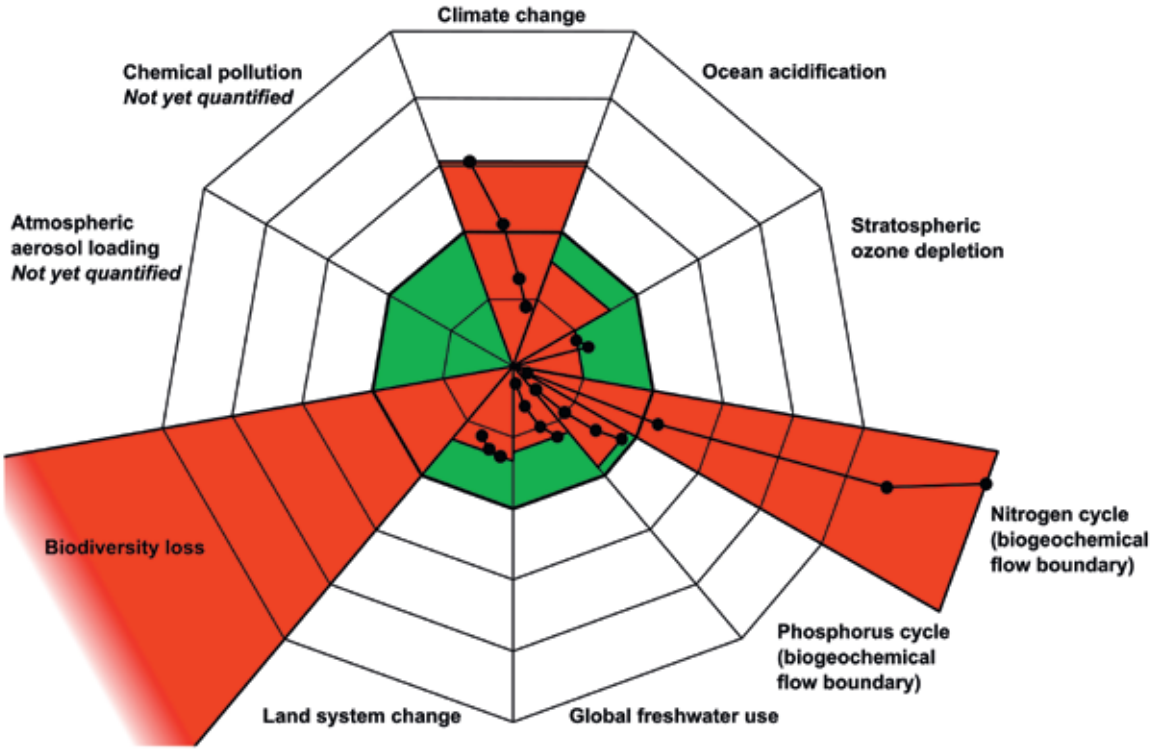

Figure 2. Conceptual definition of a planetary boundary. The boundary is designed to avoid the crossing of a critical threshold in an Earth System process. Insufficient knowledge and the dynamic nature of the threshold generate a zone of uncertainty about its precise position, which informs the determination of where to place the boundary. The inner green shaded area represents the safe operating space with proposed boundary levels and the points show the estimated course of the variable in 20 year intervals, between 1950-present. Reprinted with permission from the author(s). Source: Rockström, J. et al. 2009. Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society 14(2): 32. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/.

Photo: Jakob Granit, SIWI

planetary scale, it is more likely that global freshwater use acts as a slowly changing variable that undermines resilience through indirect changes to green water flows, impacts on the provision of terrestrial ecosystem services and through the alteration of the balances between vapour flows and runoff.

The planetary boundaries framework is not the last word in defining the relationship between humanity and our own life support system. Rather, it should be viewed as the opening of a deep, profound conversation on the future of homo sapiens on this finite planet. Perhaps nothing is more central to this conversation than water, simultaneously the lifeblood of the Earth System and the most fundamental resource for human well-being.

By Prof. Will Steffen, Executive Director, the Australian National University Climate Change Institute

Further Reading

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Slash and Learn

Dr. Aracely Castro of the International Center of Tropical Agriculture presents a new model of agricultural management that makes life better for farmers, the soil they till and ecosystems that surround them. Lesson one: mulch, don't burn.

Practised by over 200 million people, slash and burn agriculture covers 20 percent of all tropical land area worldwide. The process is practiced because it does offer short-term benefits. It provides firewood, nutrients for crop development, and kills pests. But in the long-term it destroys the soil and productivity of the land to the point where most plots are abandoned within three years. The continued deforestation has devastating impacts on the environment: ecosystem services and biodiversity are reduced while huge portions of carbon are released into the atmosphere. The Food and Agriculture Association of the United Nations estimated that 25 percent of man-made carbon emissions came from deforestation. It also poses great risks for the farmers: Burnt soil is drier and less fertile, which increases the chance for crop failure in a dry season.

In the rural village of Quezungual, Honduras, agricultural innovators found an alternative that worked so well for the local population that they named their system after them. The Quesungual Slash and Mulch Agroforestry System (QSMAS) is a smallholder production system that combines simple principles with smart technologies and practices to improve the management of vegetation, soil, water and nutrients in drought-prone areas of the sub-humid tropics. The first step is to manage the natural vegetation, not burn it, through selective and progressive "slashing-and-pruning". Next, the biomass from the trees, shrubs and weeds are used to enrich the permanent soil cover. Potentially damaging forms of agriculture, such as tillage and direct seedling are replaced. Finally, fertilisers are applied at the appropriate time and place.

QSMAS has already been adopted by 6,000 farmers in 7,000 hectares in Candelaria, Honduras, and is expanding throughout Latin America. The mulching is paying off: runoff, erosion, water turbidity and surface evaporation have gone down dramatically, while infiltration, green water use and soil water storage capacity have increased. Essentially, the increased quality of the soil boils down to more crop per drop of water and hour of labour. That is not a hard sell to pitch: and that is why local farmers are spreading the word to their neighbors in Nicaragua (Somotillo) and Colombia (Suárez) where the system has taken root. Dr. Castro is confident that the system could be adopted by smallholders under similar conditions in sub-humid tropics worldwide. The potential to mitigate climate change and improve food security to millions is enormous.

By Josh Paglia, SIWI

Photo: Mikael Ullén/SIWI

Dr. Aracely Castro received the 2009 World Water Week Best Poster from Dr. Akiça Bahri of the Scientific Programming Committee for the entry "Improving the efficiency of rainwater use on hillsides in the sub-humid tropics: agricultural & environmental benefits of Quesungual system".

Slash and burn

- Non sustainable; production plots usually abandoned after two to three years.
- Above-ground carbon stocks are severely reduced in the short term.
- Soil fertility declines after burning due to the loss of nutrients through volatilisation, drift of ashes, soil erosion and crop nutrient removal.
- High rates of soil erosion due to lack of soil cover and the loss of soil structural stability.
- Production plots provide firewood only once from the conversion from secondary forests.
- Deforestation due to shifting cultivation and extensive extraction of firewood.
- Loss of biodiversity due to deforestation.
- High vulnerability to extreme climatic events.
- Reduced water availability in soil for crop production.

Slash and mulch (QSMAS)

- Sustainable; production plots exist on farmers' fields up to 10 to 12 years.
- Carbon increases over time from biomass accumulation.
- Fertility is sustained and even increased due to spot fertilisation and nutrient recycling through management practices.
- Low soil erosion in the rainy season due to permanent soil cover and improved soil structure and stability through soil organic matter.
- Production plots provide firewood and other wood products (e.g. timber) during their productive life.
- Regeneration of the native vegetation.
- Restoration and maintenance of biodiversity.
- High resilience of the whole landscape to effects of climate change.
- Improved capacity to utilise rainfall, store and provide water for crops during dry spells.

Flood Management: Why it Matters for Development and Adaptation Policy

Our species has always lived with floods. But they remain poorly understood and managed. Floods are part of a natural cycle that can never be fully controlled. Yet, traditional terminology and prevailing attitudes remain focused on a futile and often counter-productive mandate for "flood control". As Joachim Saalmueller explains, it is time to move towards an integrated approach to flood management to save lives, increase resilience, and take advantage of the benefits to be gained in the floodplain.

When devising land and water resources policies we need to take a more holistic view of floods, one that goes beyond looking at the immediate misery they can cause. Instead, policymakers should take an approach that also considers the beneficial effects of floods and that assesses different action alternatives for specific societal development objectives. This type of analysis would lead to questions like: What is necessary to make our cities and infrastructure more flood resilient? What level of safety against flooding are we willing to pay for and what risk are we ready to accept? In the season or year after a flood event, what positive impacts can be expected on groundwater resources, agriculture and fisheries and on the livelihoods dependent on those resources? What strategies can be implemented to use floodwaters more effectively, especially in arid or semi-arid countries?

A triple challenge: Population growth, urbanisation and economic development

Population growth is the major challenge for flood managers for two reasons: First, more people need more food. And, when wealth increases along with population, trends show that the amount of dairy and meat in people's diets increases, too. This then requires exponential growth in agriculture and fisheries outputs. Both of these sectors are closely linked to floods. Land, particularly arable land, is a scarce resource and floodplains are the most productive areas for rainfed agriculture. Agriculture serves in most developing countries as the primary support for people´s livelihood. Flood management needs to aim at strengthening rural livelihoods by maximising the use of floodplain resources. Inland fisheries also depend on the regular flooding of the floodplain as spawning grounds for fish.

Second, with rapid population growth and urbanisation comes expansion of existing settlements into areas closer to rivers, which effectively increases flood risks. Population and economic growth can also lead to large-scale and often uncontrolled land conversion. This can have critical effects in terms of deforestation and altering the hydrological properties of the catchments, which in turn leads to the accentuation of flood peaks and increased sedimentation.

Healthy rivers and ecosystem services

The thinking behind floods has been strikingly narrow. In the past, floods were dealt

Photo: Schweizer Luftwaffe

with primarily by placing physical structures in or around water bodies. This approach is fundamentally flawed. Flooding is not always something to be avoided; it is can be necessary to support ecosystems, which provide services that are essential to human livelihoods. Sometimes attempts to contain floods have been destructive: rivers can be diverted into channels and carved into homogenous shapes that disrupt the ecosystem, and result in biodiversity loss in the river corridor. While structural measures should continue to play a vital role in future flood management, any such structures will have to be planned to meet multiple (and sometimes conflicting) sets of objectives derived from expanded societal values. Today, these include broader values such as flood safety, ecosystem health, biodiversity, and recreational uses of water bodies.

"Flood-free" & "climate proofing": An open invitation to misinterpretation

Political leaders in flood prone areas are under considerable pressure after large flood events to devise appropriate strategies. Those are too often labeled only with concern to the immediate political message, not to the achievable result. A common example is to label an area "flood-free" after certain technical measures have been taken. Another more recent example is the labeling of a strategic adaptation concept "climate proofing". While both terms are well intended, they suggest that we can completely control the impact that climate events have. This is simply not possible and for flood management professionals, these terms represent a threat to the integrity of the profession. It is dangerous to allow the public to take for granted what is implicitly contained in such terms: "I am safe wherever I am after those measures are taken" or "we can 'proof' ourselves against climate change impacts". That is counter-productive, and, at worst, it can be fatal. Individual and community preparedness are at the centre of safe and smart flood management. It is crucial to account and prepare for the residual risks that follow the implementation of flood management measures.

That is why water resources managers and ecologists are pushing institutional terminology away from flawed strategies for "flood control" and towards achievable targeted strategies such as "flood mitigation" and "flood risk management". For flood managers, risk analysis forms the baseline for managing floods. In basic terms, assessing risk involves analysing both the probability that a certain event will occur and the likelihood of particular consequences. Understanding risk, in terms of the flood hazards and the vulnerability of socio-economic assets and activities represents a challenge in itself, both in terms of technical capacity and resources. Evaluating risk on a catchment or basin scale is required to avoid mere spatial shifting of flood risk.

Floods cause fluctuations of water resources, yet the resources brought by floods are rarely managed to full benefit. This does not receive enough attention in the policy debate.

Risk management practice is far too often exclusively applied to economic efficiency parameters. While risk management should be included as an essential element of an integrated flood management policy, managing floods requires much more. Floods cause fluctuations of water resources, yet the resources brought by floods are rarely managed to full benefit. This does not receive enough attention in the policy debate.

The policy debate needs to begin to focus on which flood risks are acceptable, which need to be avoided by all means, and how risks can be equitably shared. This includes both the actual losses and the cost of risk mitigation. The standard scenario placed in the policy debate is that flood losses are on the rise. Public perception tends towards connoting that negatively. Economists, however, may also come to the conclusion that the rise in flood losses has a major driver in economic development. The question thus becomes: Can an overall reduction in flood losses can be achieved? Or should we aim at more refined policy goals that seek to minimise the losses of human lives first and foremost and also maximise the net-benefits gained from the floodplains? If we strive for the latter, that would also help to ensure that the risks taken in terms of development on the floodplain do not outgrow the benefits.

As flood managers work towards balanced options that represent compromise or agreed solutions rather than "optimal" ones, they must engage a wide range of stakeholders in the process. Agreed solutions have to be implemented across sectors, institutional and administrative boundaries, which presents major challenges.

Finding help

Flood management is about much more than minimising economic losses and damage. It requires intelligent management of both the floodplain and water resources generated by floods. Doing this well can support development instead of preventing it. Separating the floods from the development and natural resources context in which they occur increases the risk that poverty alleviation and adaptation strategies will fail.

The recently established HelpDesk for Integrated Flood Management, created by the World Meteorological Organization and the Global Water Partnership, provides a mechanism to support and assist countries to shift to better flood management practices. The facility offers services to countries to formulate flood management policies and strategies and the legal framework to it. It also helps build capacity for Integrated Flood Management, which can reduce the losses of life from flooding and maximise the efficient use of floodplains. The HelpDesk is founded on a broad set of partner institutions that are committed to provide strategic and technical guidance to countries. More information and possibilities for requesting for assistance can be found at www.floodmanagement.info.

By Joachim Saalmueller, Project Officer,
Associated Programme on Flood Management Climate and Water Department
World Meteorological Organization

Photo: Getty Images

Innovation's Accelerating Interest in Water

Over the past decade the world of innovation has evolved to become more strategic, more open and more focused on the big issues. Innovation expert Dr. Tim Jones predicts that over the next decade, water will become as central to every company's innovation agenda as issues such as carbon, web 2.0 and wellness are today. While to those in the water industry this may be seen as a long time in coming, for those in many organisation's innovation team, this is a major shift.

Innovation as an issue has risen up from being a research and development or marketing priority to become a CEO area of focus. Supported by consistent evidence (e.g. innovationleaders.org) that successful innovation drives growth more effectively than other alternatives, more and more companies have sought to raise it into the core of the corporate agenda: Pretty much every CEO speech now mentions innovation as well as sustainability.

As innovation has grown up, it has become focused on the bigger issues. In a desire to address major challenges, what are often called the 'catalysts for innovation' have become more significant across multiple sectors. The food industry, FMCG, financial services and consumer electronics have all placed 'wellness' as a core priority; Web 2.0 has been a big issue for the media, publishing, communications and IT sectors; and carbon has spread from energy and transport to become central to most companies future agendas.

As organisations such as Shell, IBM and now Vodafone (through the new futureagenda.org programme) have all looked forward, water has increasingly played a big role. Shell's Technology Futures programme in 2004 highlighted that water is more significant than oil; IBM's Global Innovation Outlook programme had a deeper focus on water and the Future Agenda programme has water as a key topic for debate. Clearly companies outside the water sector all now have water on their radar and are trying to identify the roles that they can play.

Accompanying this strategic insight route, more consumer focused companies are becoming increasingly aware of water as a mainstream media issue. Over the past year, The Economist, Financial Times, Wall Street Journal and the BBC have all done major features on water, and especially embedded water, and so consumer research is now beginning to pick up signals that this is a rising public concern that will influence decisions going forward.

As a consequence of all of the above, as we help companies understand and prioritise their future growth options, we are seeing water as the constant issue in every discussion. Whether from a threat or opportunity stand-point, many major global companies are grappling with the topic. We are now seeing a number of different innovation reactions. Some are small right now, but have the potential to grow, while others are major from the start.

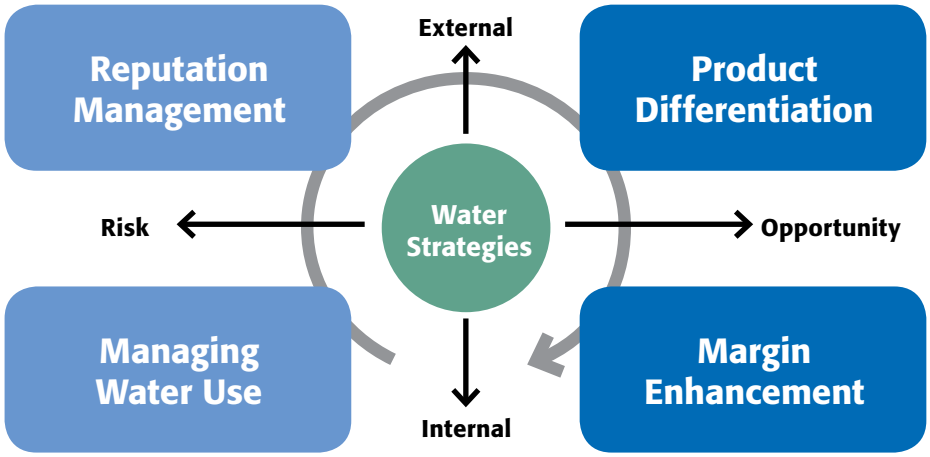
Clearly there are several sectors who are high water users. They understand that potential water scarcity is a pivotal issue

for their future. Materials companies such as Dow, DuPont, Alcan and Corus are all looking at ways in which they can innovate more around the water they use as part of their production processes. Over the past decade Dow, for example, has reduced the amount of water produced per kilogramme of product by 35 percent and lowered its freshwater intake by more than 50 billion gallons (400 billion litres) a year.

Equally, the automotive industry, the IT sector and the food and drinks industry are also concerned about both future 'security of supply' issues as well as emerging consumer sentiment. Everything that people have been worried about around energy can evidently be applied to water – price, security of supply and scarcity. In these companies, concern about managing water use is seen as an innovation priority for both internal resource risk and external reputation risk. They are busy getting accurate views of their individual water footprints so that they have the data to track and guide improvements going forward. Some are already declaring future water use ambitions while others are keeping their cards close to their chests.

Other organisations have started to see water as a major innovation opportunity and an issue upon which they can base new growth prospects. Some of these are focused first on product differentiation from a water use point of view. SAB Miller has been the most progressive of the drinks companies to declare a target of 25 percent reduction in water use. One can expect to see that migrating onto product labelling as a consumer facing claim shortly. Equally Nike and Timberland have announced plans to label embedded water on some of their products and several food companies are readying themselves for water to join salt and fat as a primary label requirement. In the FMCG arena both P&G and Unilever are using reduced water consumption in TV adverts and clearly believe that it is an important brand enhancement issue that will influence consumer choice. Lastly, within the next year, a major car manufacturer has plans to include embedded water as a key part of its consumer facing data alongside carbon emissions. Water is going to be on more consumer's minds and so companies are proactively preparing for this.

On top of this, several major organisations have looked at water and seen it as an area where they can grow significant new businesses. GE, for one, has had an increasing focus on water as part of its ecomagination programme that is now the primary platform for the growth of the new businesses. If GE makes water a priority then pretty soon so will many followers. The other big company to have already declared its ambitions is IBM, which has moved from seeing water as a risk to an opportunity. At a single plant, IBM achieved savings of USD 3 million while increasing output by 33 percent through improved resource management. This included a 27 percent reduction in water purchases, almost USD 1 million in water treatment savings, and USD 1.5 million in energy savings, without incurring any capital cost. After seeing water as an issue in 2004 and so including it in its emerging business organisation as a primary innovation platform, IBM launched its first water business focused on smart metering in April 2009. This is only the beginning: The IBM EBO programme is a high impact innovation engine that produces a host of multibillion dollar new businesses and water will feature highly in many of these going forward. As well as these, we know several major multinationals who are preparing to launch new "water" businesses in the next year or so. These have all come from their strategic innovation programmes and all have expectations of significant global impact.



Although originally seen as a largely internal risk issue, many companies are now seeing water as a topic on the external agenda and an opportunity platform. Source: Water Strategies

Photo: Michal Zacharzewski/SXC

Consequently, companies outside the water sector are increasingly interested in help from within it. The competences that many are now seeking to develop are abundant within the water industry. But they may not yet have been applied outside. Looking forward, we see that the use of water will be the single most influential factor on the innovation agenda of many key firms. This is not just about water joining carbon on the corporate responsibility agenda, either. As some of the examples above highlight, water is emerging as a primary source of competitive differentiation. The convergence of water and innovation is both underway and accelerating fast. Interesting times!

Dr. Tim Jones is Founder of advisory firms Innovaro (www.innovaro.com) and Water Strategies (www.waterstrategies.co.uk)

Fixing a World and Not Just an Economy in Crisis

By 2030, we will need two earths. That is, of course, if we plan to supply enough natural resources to maintain current consumption patterns. As world leaders look to recover from the current economic downturn, they must make sure financial reforms do not close the tap on investments to address a growing water crisis, says Prof. Luis Veiga da Cunha.

One year ago, the world sank into a global financial crisis of exceptional proportions. For a while the clear contrast between an economy in freefall and the patchwork of inconsistent national regulatory systems was appalling. The final extent of the crisis cannot yet be fully evaluated by the governments and the international financial institutions.

We face a very real danger that the anxiety to get the economy "back on track" may sweep environmental concerns under the carpet. In many countries, social crisis may be lurking around the corner and could still burst, in more or less violent forms. Losses in biodiversity, rapid ecosystem changes and climate change are providing very worrying signs that an environmental crisis could soon assume particularly serious proportions.

Unfortunately, many still believe that, once the economy is fixed, in a couple of years, everything will return to business as usual, creating the conditions to handle the social and environmental problems. One thing at a time, thus.

Others, however, believe that there will be no choice but to carry out thorough reforms that might guarantee an effective global governance of the financial and economic systems. And they feel that it is important not to set aside the necessary social and environmental global reforms when conceiving and implementing those policies.

Beyond capacity

From its revolutionary conception just two centuries ago, industrialisation has brought about a new model of civilization. Its main drivers – industry, agriculture, urbanisation, transportation, demographic growth and technological development – have engendered a level of consumption that quite simply can not be sustained. Natural resources are at present degraded faster than they can be renewed. We are, in fact, depleting our natural capital, placing at risk our future prosperity and our very survival. This is a very recent phenomenon. Despite its violence, the assault on our resource base has been quickly accepted as a "normal behaviour" by governments, economists, and citizens.

But things are far from normalcy. Ongoing rapid growth and exploitation have begun to set off massive transformations of the environment. Mankind is no longer able to control the feedback mechanisms that may result. Climate change is a good example. In just two centuries, we have transferred to the atmosphere (in the form of gasses and energy) half the hydrocarbons that had taken millions of years to accumulate on Earth. And water is indeed seen as the major mediator in this process, due to its role across the various economic sectors of our society.

Overconsumption of resources, most strikingly water, is placing our species on a dangerous path. The WWF Living Planet 2008 Report projected that if natural resources usage continues to rise according to present trends, by 2030, it will take the equivalent of two planets to meet global demand. If all of Earth's inhabitants currently enjoyed living conditions similar to the average North American, it would take five planets to support them.

Leadership is needed. It is unclear whether governments believe that the imbalances imposed on natural resources will eventually sort themselves out through the intervention of some kind of environmental "invisible hand". It happens, however, that these environmental changes might soon grow to an incomparably larger intensity than in the past, since the advent of human societies on Earth.

Jeffrey Sachs, the president of the Earth Institute at Columbia University, has recently advocated the need for a new Bretton Woods agreement, which should encompass four domains: (i) global restructuring of the financial system; (ii) bringing climate change under control; (iii) aiding reduction of poverty, hunger and disease; (iv) implementing a stable world trade agreement.

The global financial, development aid and international trade systems must be reformed together so that global ecosystems can be maintained. This should always take into account the multiple interactions and feedbacks between these four domains. This is, after all, in line with the definition of a complex system, as it is the Earth's Global System.

Facing the water crisis

In the environmental system, four main components appear to be primordial: water, energy, food security and climate change. These are connected through close interactions and feedbacks. For example, growing and transport of food takes tremendous water and energy while water can both create and require energy depending on how it is used. Burning fossil fuels or slashing forests for agriculture can alter the climate system, the main impacts of which are felt through an imbalanced hydrological cycle that makes rain patterns less predictable for farming communities.

Water is increasing coming to the fore as a priority. The recent United Nations World Water Development Report 3 warns in an unprecedented fashion that extremely serious consequences may result from the neither equitable, nor sustainable way water is currently used. Both economic development and security are put at risk by poor water management.

That is why the well established concern about a global energy crisis has recently

started to be accompanied by the concern with the well-documented but oft ignored looming global water crisis. The energy-water nexus – both the energy footprint of water use and the water footprint behind energy production - is gaining attention.

Over the past year, the possible arrival of "peak water" (see Stockholm Water Front, December 2008) has highlighted new urgency to address the crisis. Though water is a renewable resource, it is still limited. As water resources creep closer to being insufficient to cope with demand, water scarcity may become worse than oil depletion. Alternative energy sources exist. There are no substitutes for water.

Efficiency: Only a partial solution

It is argued that there are still huge gains to be made to increase water use efficiency. This is true but there are limits. Domestic and industrial water use efficiency can be improved through current and foreseeable technological development. The space for major improvements in efficiency is definitely more limited in agriculture and forestry. Huge amounts of water are consumptively used through evapo-transpiration to grow trees and crops. This is particularly important because water use for agriculture corresponds to 70 percent of the total global water use and for more than 80 percent in many low and middle income nations.

It is also clear that pressures driven by the expected global warming and by population increase will only worsen this situation. These increased pressures could perhaps be managed through adequate measures to mitigate climate change and enable adaptation with the help of science and technology. If the improvement in water productivity achieved in agriculture in some areas in recent years could be extended globally, then water resources should probably be able to cope with the 50 percent increase in the world population that is expected over the next four decades. Unfortunately, much higher pressures are expected to develop as a large segment of the global population, including countries such as China, India and the countries of Southwest Asia, raise their standard of living. Such countries are reaching economic and educational levels that fully legitimate the wishes of their citizens to approach the standards of living and consumption of the citizens of the developed countries.

In order to control the severe water crisis that looms on a non distant horizon, we will need to show extraordinary creativity. We need to set in motion systems of governance and regulation that are capable of ensuring long-term sustainable development. If politicians are solely concerned with recovering the financial system's stability and ignore the social and environmental domains of the Earth's system, then it might be possible, in the short term, to get the financial system on its feet. But in the long term, the planet's health will again be stricken down by water scarcity, energy crisis, food insecurity, and climate change.

The threat of a global water resources crisis is both very frightening and entirely probable. We must concentrate on the global project of protecting mankind through the preservation of the natural resources. We will need creative solutions to simultaneously confront the financial, social and environment global crises. Our main concern must be to create, with the utmost urgency, the necessary conditions for human creativity to flourish in the domains of politics, science culture and ethics. World leaders need to put this at the top of their agenda. Clearly the most urgent task is to establish the centrality of water problems in the not so distant crisis threatening the future of humanity.

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Illustration: Jan Kratena

Photo: Håkan Tropp, SIWI

Heart of Dryness:

How the Last Bushmen Can Help Us Endure the Coming Age of Permanent Drought

In *Heart of Dryness: How the Last Bushmen Can Help Us Endure the Coming Age of Permanent Drought*, author James Workman tells the story of the Kalahari Bushmen's struggle to stay on their homeland in the Central Kalahari Game Reserve in Botswana and the Botswana government's efforts to drive them from those lands. Workman focuses on the role of water in that struggle, starting with the government's 2002 decision to turn off the reserve's water supply. This controversial action forced Bushmen to choose either resettlement in government camps outside the reserve or life on the reserve with no reliable supply of water. Even in the face of drought, part of the Tribe chose to remain on the reserve. This book tells their story and argues that their methods for survival should inform water policy in the coming age of what Workman calls "permanent drought".

For tens of thousands of years, the Bushmen and their ancestors lived in what local languages translate as "the Always Dry" or the "the Great Thirstland," better known as the Kalahari Desert. The tribe once thrived across Southern Africa but perished as development and disease were brought to the African continent over time. As the Bushmen tribes continued to disappear, the British colonial government established the reserve in 1961 "for traditional land use by hunter-gatherer communities of the Central Kgalagardi where the last surviving bands could develop on their own terms, free from relentless persecution to near extinction." Numbering about a thousand people at the time, the remaining band established itself in autonomous communities inside the reserve.

Years later, for reasons explained in detail in *Heart of Dryness*, the Government of Botswana decided that the Bushmen were no longer welcome on the Reserve. Instead, the lands and limited water would be devoted to more "progressive" uses, such as diamond mining and tourism. A programme of "voluntary" government resettlement began, but the Bushmen did not give up their homeland easily. Eventually, the conflict led to the water shutoff in 2002 and later to a case before the Botswana High Court.

The book offers a surprisingly personal and often touching account of the Bushmen's struggles. An American journalist turned water policy expert, Workman was drawn to the Bushmen's story while living in Africa, where he worked on the World Commission on Dams Report and other water-related issues. He went into the Reserve several times, learning firsthand the story of the Bushmen and their fight to stay at home and to preserve their culture and ways on the land the government had promised them. Witnessing how the Bushmen's lives, customs, and traditions were built largely around conservation and use of water, Workman "began to absorb the larger context and deeper meaning" of the story from a water policy perspective: "By managing to cope without government water while drought crippled the surrounding state," Workman writes, "the dissident Bushmen revealed the inherent fallacy of centralised water control. … In the face of scarcity all water, like all politics, becomes emphatically local."

From that realisation, *Heart of Dryness* uses the Bushmen story as a launching pad to discuss many of the most contentious issues in water policy today, from privatisation of water supplies and delivery systems to water as a human right. Focusing primarily on water management in the United States, the book also emphasises that, as we struggle to manage decreasing water supplies in the face of global warming and increasing demand, there is much that modern water managers should learn from the Bushmen. Further, Workman warns, a water crisis is looming – the "time of permanent drought" referenced in the title of the book.

Permanent drought is defined in the book as follows: Set against the background equilibrium patterns of previous decades or centuries, measurable drought occurs whenever mean temperatures escalate hotter, water tables sink deeper, evaporation rates accelerate faster, runoff shrinks lower, reservoirs vanish sooner, dry seasons last longer, or economic thirst of more people

demands more water from re activity than ever before. Of course, nothing prevents all these unpleasant forces from compounding at once, and the consensus of scientists suggests that in the United States we are now entering precisely that convergence. This scenario is known as a perfect, perpetual, or permanent drought. It means that in spite of unprecedented prosperity and freedom in most other sectors, and in spite of the undeniable convenience of cheap running taps and USD 8 billion worth of bottled water on supermarket shelves, Americans enjoy less absolute access to water than ever before.

So, while the United States managed its highly technical water systems into a system of profligate waste, the Bushmen of the Kalahari, says *Heart of Dryness*, managed to "get it exactly right." What are typically viewed as sacrifices or extreme conservation measures outside the Reserve are a way of life for the Bushmen. Bushmen practices could inform effective, modern water use methods and conservation. As outlined in the book these include, among other things: using less water, treating water as a precious necessity, cultivating arid-adapted indigenous plants, recycling gray water, and converting to low- or no-flush toilets.

Of course, there is no easy ending, either for the Bushmen or for future water policy makers. Eventually, the Bushmen brought their case before Botswana's High Court, seeking justice in a courtroom when none could be found in the desert. Even those who know the outcome of the Court's decision will find a page-turner within *Heart of Dryness*, as it builds the case and describes the courtroom saga leading up to the long-awaited decision, which was issued in 2006.

As for the policymakers, the book's final chapter offers a proposed approach to a solution and hope for the future. "If our competitive demand for scarce water drives us apart and escalates tensions," Workman writes, "this same finite supply of freshwater is also itself what ultimately drags us back and binds us together. We may not like the rule of increasingly scarce water, but at the same time, we cannot escape it. And [the Bushmen] band demonstrated how to embrace that reality. [Their] fundamental rule of adaptation was not to organise and mobilise physical resources to meet expanding human wants, but rather to organise human behaviour and society around constraints imposed by diminishing physical resources. To reiterate this book's theses: We don't govern water; water governs us."

Megan Walline,
Fulbright Scholar and Visiting Researcher, SIWI

Photo: James Workman

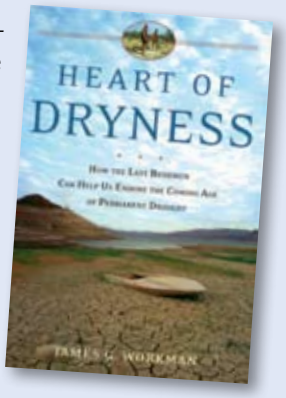
Wild tsama melons are gathered into a secure Kalahari equivalent of a water tower.

Photo: James Workman

For tens of thousands of years, the Bushmen and their ancestors lived in what local languages translate as "the Always Dry" or the "the Great Thirstland," better known as the Kalahari Desert.

About James Workman

James G. Workman began his career as a journalist in Washington, D.C., for the New Republic, Washington Monthly, Utne Reader, Orion, and other publications. He helped edit and launch the report of the World Commission on Dams, and spent two years filing monthly dispatches on water scarcity in Africa, work which formed the basis of a National Public Radio show and documentary.



Heart of Dryness: How the Last Bushmen Can Help Us Endure the Coming Age of Permanent Drought

ISBN: 9780802715586
Published: Walker & Company, 08/01/2009
Pages: 323

HELCOM Honoured for Baltic Leadership

The Helsinki Commission (HELCOM) has been named the winner of the 2009 Swedish Baltic Sea Water Award. The award, which is presented annually by Sweden's Ministry for Foreign Affairs, was announced by the Swedish Minister for International Development Cooperation Ms. Gunilla Carlsson at the Baltic Sea Seminar during the 2009 World Water Week in Stockholm.

HELCOM works to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental cooperation between Denmark, Estonia, the European Community, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. The organisation is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" – commonly known as the Helsinki Convention.

The Swedish Baltic Sea Water Award highlights important work towards halting the Baltic's deterioration and improving its ecological balance. Because of its special geographical, climatological, and oceanographic characteristics, the Baltic is highly sensitive to the environmental impacts of human activities in its sea area and its catchment area, which is home to over 85 million people. The Sea currently suffers extensive eutrophication from phosporous and nitrogen pollution that causes large-scale algae blooms, as well as overfishing, oil spills, waste from cruise ships, and an oxygen depleted-seabed, among other problems.

Photo: Mikael Ullén/SIWI

HELCOM Executive Secretary Dr. Anne Christine Brussendorff (right) with Swedish Minister for International Development Cooperation Hon. Gunilla Carlsson (left) at the prize announcement.

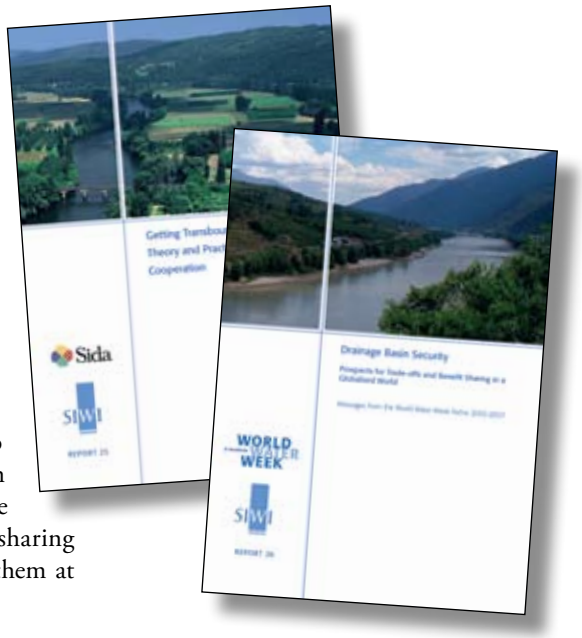
"HELCOM and its secretariat under Executive Secretary Anne Christine Brusendorff have taken marine environmental protection to a new level," noted the Swedish Baltic Sea Water Award Jury in its citation. "HELCOM has shown exemplary commitment to improving the Baltic Sea through the adoption of the Baltic Sea Action Plan. The Action Plan takes on the complexity of issues that need to be addressed in an innovative manner, linking it to ongoing initiatives and becoming the backbone of the environmental actions in the coming Baltic Sea Strategy. "

HELCOM received the Swedish Baltic Sea Water Award from the hands of H.M. King Carl XVI Gustaf of Sweden at a ceremony in Stockholm on September 17 in connection with a dinner hosted by EU Minister Cecilia Malmström on the eve of a Ministerial Conference on the EU Strategy for the Baltic Sea region.

SIWI Reports on Transboundary Water and Drainage Basin Security

SIWI introduced a new report developed to serve as a primer on transboundary water management: *Getting Transboundary Water Right: Theory and Practice for Effective Cooperation*. The report challenges the international water community to integrate new conceptual thinking in the field with lessons learned from transboundary water basins around the world. "Stakeholders in transboundary basins face a choice between cooperation to gain mutual benefit from their shared water resources or just competing for simple access and volume," said Anders Berntell, Executive Director, SIWI. "We believe that this report helps make a strong case for cooperation and collaboration. We hope that this report can help those stakeholders make the case themselves within their own countries."

SIWI also launched the report *Drainage Basin Security – Prospects for Trade-offs and Benefit Sharing in a Globalised World*, which looks back over the World Water Week niche on Drainage Basin Security that covered the years 2003 to 2007. The report reflects on the knowledge, experience and lessons learned over the course of the five years, and offers a set of key messages that emerged from the plenary sessions, workshops, seminars and side events. The aim is to provoke further thought and action on drainage basin security and the prospects for trade-offs and benefit sharing in a globalised world. Download them at www.siwi.org.



SIWI Welcomes new Deputy Executive Director


Mr. Per Bertilsson.

This September, SIWI welcomed Mr. Per Bertilsson as its Deputy Executive Director. At SIWI, Mr. Bertilsson will lead the strategic development and operation of the institute's programmatic work in capacity building, applied research and advisory services.

Mr. Bertilsson brings over 30 years of experience working with natural resources and environmental management, water resources management, physical planning and infrastructure development, including policy formulation, planning, implementation and operation and maintenance. He has worked extensively in Asia and Africa leading projects for the Swedish International Development Cooperation Agency (Sida), private companies, several UN agencies, the World Bank, the Inter-American Development Bank and Governments.

"We are very excited to welcome Mr. Bertilsson to SIWI this autumn. His impressive track record for strong leadership and strategic programme management is a tremendous asset that will greatly contribute the development and improvement of all facets of our organisation," said SIWI Executive Director, Mr. Anders Berntell.

Dr. Anders Jägerskog Takes Two Year Post with Sida

Dr. Anders Jägerskog, Project Director, SIWI, will take a leave of absence from SIWI to begin a two year posting with the Swedish International Development Cooperation (Sida) in September 2009. As Senior Programme Manager, he will lead Sweden's support to the Nile Basin Initiative and work with transboundary water resource issues throughout East Africa.

New Research on Corruption, Climate and Environmental Flows

Three new reports released by the Swedish Water House detail strategies to adapt to climate change, combat corruption in water licensing and maintain healthy environmental flows. *Adapting Water Management to Climate Change*, produced by the Swedish Water House Cluster Group on Water, Vulnerability and Climate Change, warns that addressing climate warming without giving water a central role is to fail to recognise its multi-dimensional role in ecosystem sustainability and livelihood security. *Securing Water for Ecosystems and Human Well-being: The Importance of Environmental Flows* developed in collaboration with UNESCO-IHE, the International Union for the Conservation of Nature (IUCN), UNEP-DHI, Deltares, WWF, Conservation International and The Nature Conservancy, draws on the latest research and practices on environmental flows and their significance. *Corruption Risks in Water Licensing with Case Studies from Chile and Kazakhstan*, explores ways to promote transparency in water allocation mechanisms. Download all reports at www.swedishwaterhouse.se

News Briefs from Collaborators

The full worth of wetlands revealed

It is now possible to measure the economic value of a wetland at the same time as assessing species that live there and the importance of a wetland for people's livelihoods. The new guide, *An Integrated Wetland Assessment Toolkit*, is designed for development agencies, industries and governments to make sure all elements are assessed when a wetland is drained for development. Find the toolkit: http://cmsdata.iucn.org/downloads/iwa_toolkit_lowres.pdf

Pioneering analysis of Water Footprint of plastics

Borealis, a leading provider of innovative, value creating plastics solutions, has completed the plastics industry's first assessment of the Water Footprint of plastics materials. The Borealis Water Footprint analysis was completed in collaboration with the Royal Institute of Technology of Sweden (KTH), applying the methodologies currently developed by the Water Footprint Network. The direct Water Footprint was calculated on the basis of a detailed review of water flows in manufacturing processes and production sites. Read more at, http://www.borealisgroup.com/news-and-events/company-news/2009/jku-studies1

EUR 200 million boost for water and sanitation in developing countries

During the EUWI multistakeholder forum, held during World Water Week, the European Commission announced phase two of the ACP-EU Water Facility, setting aside 200 million to help to tackle the water and sanitation problems in the ACP countries. It will begin a call for proposals at the beginning of 2010. Read more at, http://www.euwi.net/news/press-release-world-water-week-2009

Primer on "Public Funding for Sanitation"

The Water Supply and Sanitation Collaborative Council (WSSCC) released a new primer entitled *Public Funding for Sanitation: The Many Faces of Sanitation Subsidies*, a new resource for all those who work in sanitation and who seek sustainable and effective strategies for delivering sanitation to those with the biggest need. The primer is available at www.wsscc.org.

USAID launches water finance resource

www.waterfinancesite.org is a resource for development professionals who seek to incorporate sustainable financing into Water, Sanitation and Hygiene programmes. The website assists the user in determining how to structure assistance with an appropriate set of objectives and interventions for a particular country context.

2009 World Ocean Week in Xiamen bridges land, water and coastal divide

The planet's greatest challenges are converging on the coast. As warming and rising seas, environmental pollution and rapid urbanisation all flow towards the shorelines, 700 leaders in government, science, academia convened at the 2009 World Ocean Week in Xiamen, November 6-12, 2009 to highlight tremendous social, environmental and economic losses caused by the disconnected management of land, freshwater, coastal areas and oceans. Top experts discussed effective policies to integrate watershed, estuary and coastal management at a series of international, policy and scientific forums. The educational, recreational and cultural events held during the week attracted over 90,000 visitors. www.worldoceanweek.org



Get Better at Your Job

The International Training Programme in Integrated Water Resource Management offers advanced training on international, national and local IWRM tools and approaches that can be applied in practice. Mid-career professionals are sought from selected countries in Africa, Asia, Latin America, Middle East/North, Africa, Europe and Central Asia.

Full-time interactive training takes place in Sweden from August 23 – September 14, 2010 and in Lao PDR November 22 – December 3, 2010.

Deadline for applications is March 15, 2010.

Learn more about all our management training programmes and how to apply at www.siwi.org/capacitybuilding

SIWI RAMBØLL

A Consortium for Capacity Development

Looking for the Best in the Business
2010 Stockholm Industry Water Award

Do you know a business that is managing its water sustainably? Should they be rewarded for it? If so, nominate them for the Stockholm Industry Water Award! Nominations for 2010 close **15 February**.

www.industrywateraward.org

"While Trojan has been honoured to receive a number of provincial and national awards in Canada in recent years, the Stockholm Water Industry Award recognises achievement on a truly global scale. Trojan is honoured to be recognised for innovation and leadership in sustainable development of the water sector."

Marvin DeVries, President Trojan Technologies, Canada
2009 Stockholm Industry Water Award Winner