Drainage Basin Security

Prospects for Trade-offs and Benefit Sharing in a Globalised World

Messages from the World Water Week Niche 2003-2007

WORLD WATER WEEK in Stockholm

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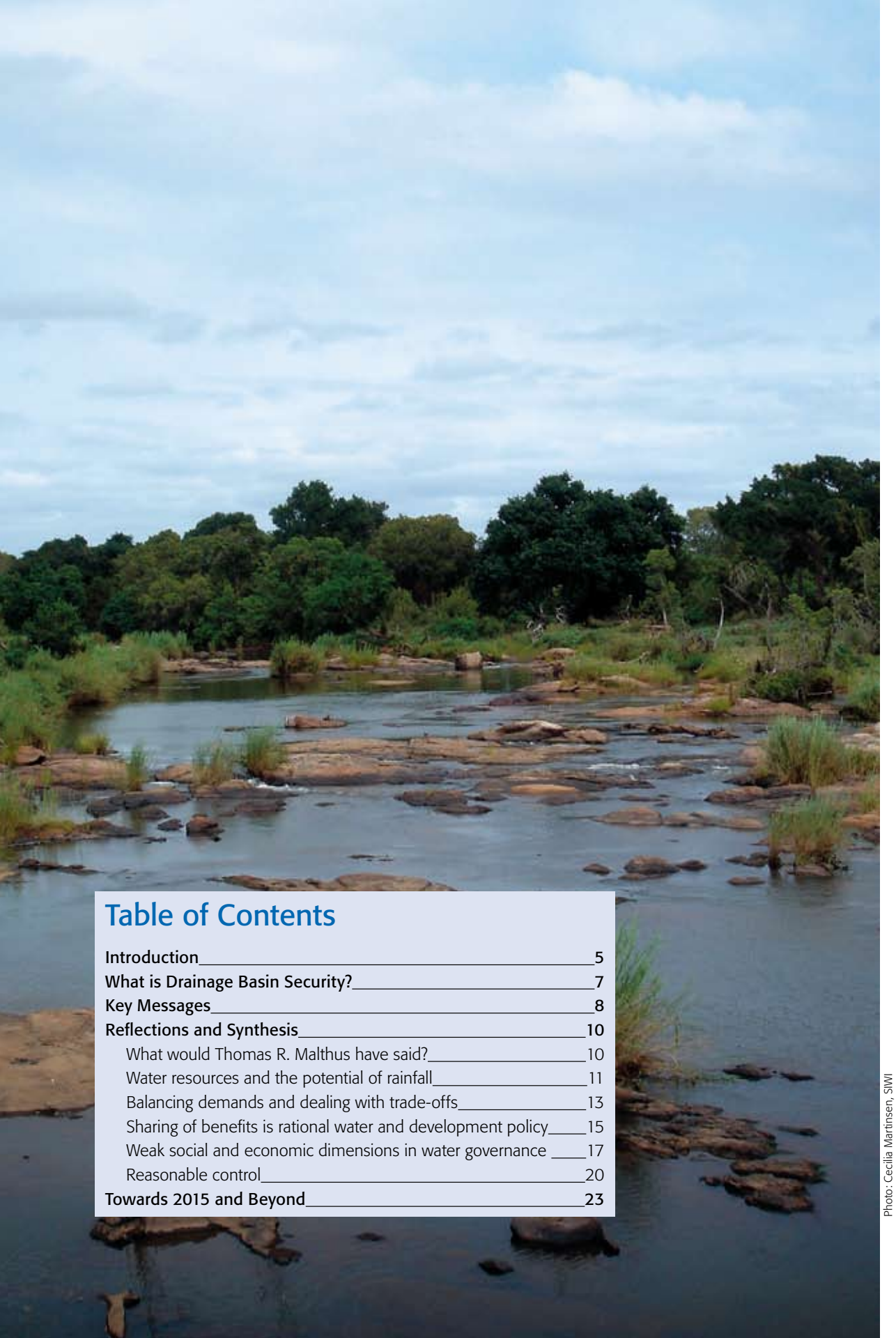

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Introduction

The World Water Week in Stockholm is a global platform that each year explores questions related to water as a resource, as a vital part of the life support system and the socio-economic development of nations. The "Week" brings together experts from government, research, business, inter-governmental agencies, non-governmental organisations, and civil society from around the world to exchange ideas, celebrate achievements and develop new thinking toward real solutions. Over the past 19 years, what was originally called the Stockholm Water Symposium has expanded in scope, number of sessions and collaborating organisations. It has grown from 250 attendees to some 2,400 attendees from more than 130 countries and over 200 collaborating organisations, and since 2003 has been aptly referred to as the World Water Week.

Since its inception in 1991, each World Water Week has addressed a particular theme that fits within what has been termed a "niche", which covers a period of between five and seven years. This structure of themes within a niche was developed with the aim to deepen our understanding of particular broad yet significant water and development issues. From 1991 to 2007, the niches have been:

- 1991-1997: Minimising harmful fluxes from land to water;
- 1998-2002: Water – the key to socio-economic development and quality of life; and
- 2003-2007: Drainage basin security – prospects for tradeoffs and benefit sharing in a globalised world.

Between 2003 and 2007, the World Water Week addressed different facets of the niche "Drainage basin security – prospects for tradeoffs and benefit sharing in a globalised world". Each year of this niche, deliberations have taken place in a vast array of workshops, seminars, side events and plenaries. This has allowed a long-term perspective to emerge on the issue of drainage basin security that encompasses many different voices on socio-economic, political and environmental aspects of water. The programme of each World Water Week over this period has addressed a different theme

within the drainage basin security niche. The themes over the last five year niche have been:

- 2003: Balancing production, trade and water use;
- 2004: Regional approaches for food and urban security;
- 2005: Hard and soft solutions in regional development;
- 2006: Beyond the river – sharing benefits and responsibilities; and
- 2007: Progress and prospects on water – striving for sustainability in a changing world.

This report looks back over the five year niche. The purpose of this report is to consolidate and reflect upon the knowledge, experience and lessons learned over the course of the five years. Several basic messages have emerged that encapsulate a perspective aimed to provoke further thought and action amongst the target audience: the World Water Week speakers and participants, the decision-makers, the experts, and the students that have a voice in how our water resources are managed.

In the first section, the niche is defined by answering the question: What is Drainage Basin Security? The key messages that emerged from the analysis of the five year niche are then presented. The section Reflections and Synthesis are thoughts and ideas that have been formulated by members of the World Water Week Scientific Programme Committee and SIWI experts based on the proceedings and reports from the five World Water Weeks under this niche. They refer to issues that have been on the agenda for the past few years and to the challenges and opportunities that are emerging or becoming more significant as we approach 2015. To conclude, the last section provides a look forward towards and beyond 2015.

A special note of gratitude is due all of the World Water Week convenors, panellists and participants who contributed their ideas, experiences, and creativity to the Drainage Basin Security sessions over the five-year period leading up to this report. SIWI is in a unique position to be able to draw upon hundreds of examples of water-related initiatives from around the world each year. It is hoped that over the course of the five year niche, many of the attendees who have brought their own examples, case studies, and projects to Stockholm were also able to take home insights and lessons that have added value to their own water-related work. This report is the result of many contributions from members of the Scientific Programme Committee and SIWI experts. Special thanks goes to Prof. Jan Lundqvist, Prof. Malin Falkenmark, Dr. Anders Jägerskog, Prof. Per-Arne Malmqvist, Prof. Peter Rogers, Dr. Akissa Bahri, Prof. Hubert Savenije, Ms. Cecilia Martinsen, Mr. Jakob Granit, Mr. Michael McWilliams and Mr. Michael Moore.

Anders Berntell,
Executive Director
The Stockholm International Water Institute

Photo: Anton Earle, SIWI

Photo: Frida Lanshammar

What is Drainage Basin Security?

Drainage basins can be defined as the geographic area drained by a river and its tributaries. Basins are fundamental units of water management strategies worldwide. They provide the spatial foundation that enables local, national, multinational and multiregional stakeholders to cooperate and benefit from all sources of water. Stakeholders can, and need, to work together to optimise the resource and its use. Drainage basins constitute life support systems. They are the basis and the home for human activities. They are also the recipient and sink of the non-desirable by-products of production and consumption.

Drainage Basin Security presumes a two-fold, interlinked systems perspective:

- **Resource security:** Water resources are a vital and dynamic component of the opportunities as well as constraints of the biophysical system. Being a finite and highly variable resource, water is also a most active agent, interconnecting upstream to downstream areas and activities in the landscape mosaic. All life depends on the proper functioning of this biophysical system, but generally, human activities, settlements and institutions are not organised with reference to the physical boundaries of drainage basins with their upstream-downstream implications.

- **Security of human activities:** A stable and continuous functioning of society necessitates that the multiple roles of water are recognised and utilised in the best way possible with the least negative side effects. Aspirations and the aggregate demand of growing populations, which seemingly command ever-increasing economic, technical and communication resources, have direct and indirect implications for water resources both in terms of multiple demands and quality "after use".

The size of basins and the degree to which they overlap or cross political and other jurisdictions, climatic variations and social and cultural divisions, determine the character of the policy and management interventions that are needed. The bigger the drainage basin, the more variety it includes, and the more thought, negotiations and concrete effort must be devoted to institutional arrangements and political guidance. Adjustment to these variations is naturally essential for proper drainage basin security.

Key Messages

Over the course of the five year niche period, representatives from academia, government and policy-making institutions, national and international organisations, the private sector and non-governmental organisations have dealt with a wide range of aspects of drainage basin security. Discussions dealt with a range of concrete cases and issues, as well as policies interlinked with scientific analysis and conceptual developments.

In this rich exchange of ideas, knowledge and practices, the following key messages emerged:

- **Drainage basin security requires coordination and integration of policies for biophysical and socio-economic systems.**[1] As a result of climatic variation water resources are not fixed. However, they can be enhanced. The amount of precipitation varies between basins, countries and over time. A range of strategies must, and can, be developed so that the rain, which determines how much renewable water is added during a season or year, is beneficially used to the extent possible. Part of the rainwater will reach the rivers and can be stored with the help of conventional infrastructure, for example in reservoirs behind dams. With proper land and soil management, a large part of the rains may be stored *in situ*, in the soil as moisture, which is referred to as "green water" resources.

- **Considerable scope exists for improving efficiency and balancing demands and tradeoffs.** Demographic and economic trends signal a rapidly growing demand for water. Enhancing the resource, as indicated in the first message above, will be important to cater to growing demand. However, experience has shown that there is considerable scope to improve efficiencies in water use. The notion of "more crop per drop" can also be read as "more value per drop" or "more employment per drop". Issues of equity and impacts are challenging in a context of increased competition and intensified resources use. Policies must be designed so that the values and benefits but also the costs, in social and environmental terms, from water allocation and use are identified and given appropriate weight.

[1] The two systems, biophysical and socioeconomic, should be seen as intertwined. The need for a combination of the human system and the natural resource system in human thinking and behaviour is common in literature. One of the most intriguing formulations can be found in the yin-yang concept. This concept symbolises the interconnectedness of all things in nature, which is a common theme in the religious and philosophical traditions of Taoism.

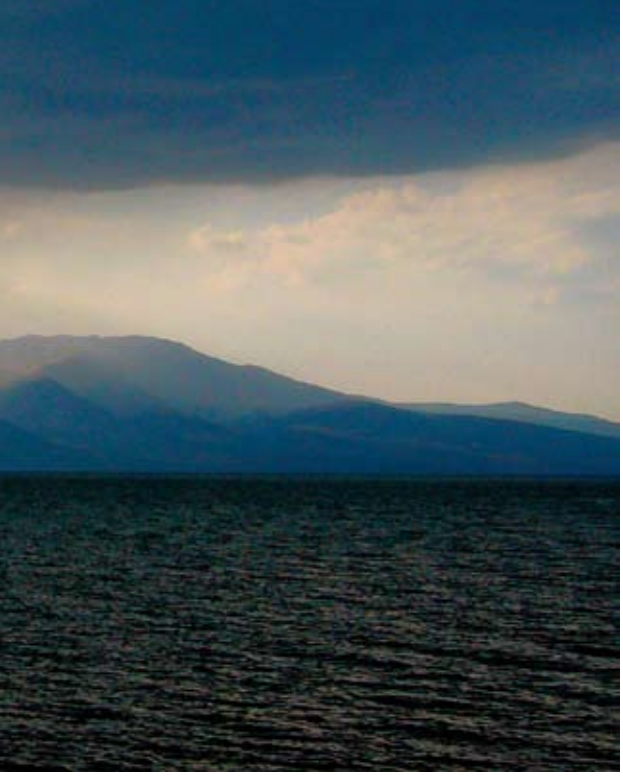

Photo: M. Zeynep Dağdevirenoğlu Kubaseck/SXC

- **For water short areas, a strategy for water and food security should include considerations of imports of water intensive goods and services.** Any community and society will naturally need water for household purposes, to run industries, schools, hospitals, etc. But the food, which requires huge volumes of water for its production, does not necessarily have to be produced in the same areas where people live and eat. It is vital that social and economic development plans of countries, with the associated proposals for allocation of investments, scientific and technical development, training, etc., are designed with due regard to water resources.

- **Strategies for sharing benefits generated in transboundary basins should be sought.** Aggregate demand for water typically exceeds the flow of water that can be developed and allocated to potential users in large, international river basins. Due primarily to political divisions, the policies and legal provisions for water and the development of sectors tend to be confined within national territories. However, sharing of water based on population size, historical rights or any other criteria, is more often than not a zero sum game. Since the conditions for best possible use of water typically vary between different parts of the basin, and since the riparian countries have a range of potential development options, it is rational to develop a mutually agreeable policy for using water in those sectors and in those sites where the greatest benefits can be generated. Combining this development with exchange and collaboration in terms of trade, cultural and scientific programmes is a recipe for positive sum outcomes.

- **Policies, management and stakeholder participation should go beyond water.** The days are gone when water governance was perceived as purely a technical issue to be dealt with by the Ministry of Water or water service suppliers. Coordination and integration of water resources management requires that we go beyond the water sector to encompass other sectors such as agriculture, energy, education, infrastructure, health and finance, and many more. Because the process involves a complex matrix of stakeholders, physical and biological realities and relationships, it calls for strategies with clear direction and transparent objectives. Civic engagement is essential to involve all levels and all groups of society in the process. Workable solutions – and the required financing – demand a collaborative effort by governments, donors, the private sector, and water users themselves. Inclusion, accountability, rights, obligations and transparency are key features of an efficient and socially acceptable governance system.

- **Be aware: doing nothing will cost more in the long run.** Although we should all know by now that water is everybody's business, we have yet to translate that recognition into meaningful compliance and effective action. For example, failure to invest adequately in both training and institutional arrangements reduces and shortens the functioning and intended benefits of water delivery infrastructure. Similarly, the creeping character of pollution should not be an excuse for postponing investments and taking remedial actions to contain or in other ways neutralise the impacts on human and environmental health. Pollution and resource degradation can affect food and industrial production as well. By failing to act now, our children and their children will have to take care of the problem.

Photo: Jan Lundqvist, SIWI

Reflections and Synthesis

What would Thomas R. Malthus have said?

Water sustains life and is an essential ingredient for socio-economic development. While the amount of water that is potentially available is stable, albeit with considerable and probably increasing variations between seasons, years and places, the number of people who depend on this resource is not. Change is the word of the day. In addition to continuous demographic change, climate, political systems and other features are changing on a global scale. The rapid and sudden appearance of the financial crisis, which has mobilised governments to take financial actions more quickly and on a much larger scale than any other crisis is a case in point. Seen in a longer time perspective, the most dramatic and far-reaching changes are related to the worsening condition of our life support system.

When Thomas R. Malthus published his now well known thesis about population dynamics and food security in 1798, the world population was less than 1 billion. By 1950 it had grown to 2.5 billion, in 2000 to 6 billion. By 2050 it will most probably have grown to around 9.5 billion. Globally, in urban areas alone, where little food is produced but where most of it is consumed or tossed away, the current number of inhabitants is more than three times the size of the entire global population at the time Malthus published his thesis. Pessimistic perceptions about population and food security have been revisited and new aspects have been added to the calculation. *However, feeding the world is not a question of the past but one for the future.* With another three billion seated around the table in a few decades, the pressure on water will reach new heights and terrestrial and aquatic ecosystems will be subject to the heavy pressure of augmented human needs and wants.

There are fewer and fewer free lunches. Producing and consuming food always carries a cost or an impact on the life support system. At the same time, the needs and demands are steadily growing. More and more people enjoy greater purchasing power and have the

political clout to demand a greater range of goods and services, which all require water or have an impact on water resources and the environment. Incredibly, at the same time, poverty and lack of entitlements to resources and services for basic human needs are affecting at least a billion people.

With population growth, there is no other option but to make sure that the stewardship of the life supporting role of water and the associated biophysical resources result in best possible outcomes with least negative impacts. An unanswered question is how socioeconomic improvements on a grand scale will affect the fate of the poor. Is the concern of our time to provide "checks", which are better for the poor than the ones that Malthus wrote?

"Producing and consuming food always carries a cost or an impact on the life support system."

Water resources and the potential of rainfall

A question that has repeatedly been raised is *whether water scarcity can be seen as a brake on development*. Naturally, views have differed. Some emphasise it is misleading to talk about water scarcity on a global scale. However, for countries exposed to water shortages, it is certainly a hindrance. The good news is that water scarcity can be overcome. In fact, it may stimulate innovation and development of new solutions. Firstly, however, we need to know what resource we are talking about.

Traditionally, formulations about water resources have focussed on the visible and liquid water in rivers, lakes, and aquifers, known as the "blue water" resource. Human interventions and investments in this part of the hydrological cycle have been substantial with commendable results in terms of many social and economic development indicators. Yet many people have not been helped, and the needs and desires for food and other water dependent goods and services are definitely growing.

In a number of World Water Week workshops, seminars and plenary sessions, it has been stressed that rainfall is the basic resource for local communities and for drainage basin security. More knowledge and practical examples are needed about how to enhance the water resource. To what extent is it possible to capture a larger fraction of the rainfall for beneficial use? Rainfall capture is vital in water-short areas and in basins where the river flow is partially or totally committed. At the same time, more must be known about how changes in water and land in one part of the basin affect other parts of the basin.

The conventional strategy to increase water security is to build dams and reservoirs. It has been emphasised by some that investments in water infrastructure are a basic necessity for economic growth in many developing countries. Infrastructure helps in coping with rainfall variability and climate change and in achieving long-term water security. In sub-Saharan Africa, storage is still quite low and less than five percent of the agricultural land is irrigated. However, due to extremely high investment costs, poor performance of existing schemes, environmental and other concerns, conventional storage will most probably not play a major role, at least not for food crops in sub-Saharan Africa. Investment for water storage for hydropower and urban water supply will continue to be an important focus in this region.

It also needs to be remembered that an estimated 1.2 to 1.4 billion people, or about 20 percent of the world's inhabitants, live in basins where the water flow in rivers is already highly exploited and committed to various users to the extent that the basins are deemed "closed" to further exploitation. More effective utilisation of water resources in a basin presumes a combination of strategies for capturing rainfall *in situ* together with other types of water storage.

Policies and strategies need to be based on the recognition that the more accessible opportunities and assets have already been exploited. For all practical purposes, for financial and environmental reasons, the pressure and competition for finite blue water resources cannot continue into perpetuity. With an increasing number of overexploited and degraded freshwater sources, it is vital to make sure that a larger fraction of rainfall can be harnessed and beneficially used. Through better coordination of land and soil management, the "green water" resource – the invisible moisture content in the soil and lifeline to terrestrial ecosystems – may be enhanced.

Drainage basin security recognises that rainfall is the gross water resource and that proper management of freshwater resources must be based on the coordinated management of water, land and other components of the biophysical system.

Productive transpiration versus unproductive evaporation

Food and biomass production is the main human appropriation of freshwater. As food and biomass production continues to increase, consumptive water use increases, which often tends to impact the environment negatively. An important distinction needs to be made that is of significant development importance: *an increase in the production of food and other biomass is proportional to an increase in the transpiration of water – the flow of water through the plants back to atmosphere. But evaporation – the unproductive return flow of water back to the atmosphere – is not related to increments of biomass.* Management of land, soils and vegetation that better relates to rainfall characteristics allows a relatively larger fraction of the rainfall to be productively used while minimising the unproductive evaporation. Since the blue water sources are heavily utilised for a number of competing activities in other sectors, for example in expanding urban centres, and since further ecosystem degradation must be avoided, it makes sense to develop strategies to use the rainfall more efficiently. Thus, a new water management paradigm needs to be put in place which aims at a better integration between land and water.

Conclusions have confirmed that it will be necessary to identify a range of options, from purely rainfed agriculture to fully irrigated agriculture. An integration of land use, water management and nutrient supply promises to generate multiple benefits: increased yields and water productivity, ecosystems sustainability and livelihood improvements.

"For some reason water and climate tend to be dealt with as two separate issues."

Producing more or wasting less?

It is widely accepted that we need to produce "more crop per drop". We know how losses and wastage of water from source to field and within the fields can be reduced. Much less is known about how to curb losses and wastage of food once it is produced, from field to fork. About a quarter to a third of the edible crop harvests are lost due to poor harvest and post-harvest technologies, including inefficient storage, transport, processing and lack of marketing arrangements. Together with the food that is wasted, i.e. food that is perfectly fit for consumption but discarded or in other ways not beneficially used, the combined losses and wastage are in the order of 50 percent. Naturally, there are large variations between countries. Losses of agricultural production imply loss of income for farmers and reduced supply in society. Programmes must be developed and put in place to support small producers in their effort to keep or sell as much as possible of what they produce. Similarly, efforts are urgently needed to reduce food wastage. *It should be remembered that all food, whether eaten or wasted, has consumed water in connection with production.*

Climate change: intensifying water-related development challenges

We must prepare for more than demographic change. Climate change poses hitherto largely unattended challenges for societies and individuals in terms of mitigation and adaptation. The repercussions from climate change and variability on water resources and, thus, on development options are significant and seemingly obvious. For some reason, however, the close links tend to be overlooked: water and climate are often dealt with as two separate issues.

Scenarios that show climate change leading to a reduction of potential yields and other significant costs are usually based at the regional or country scale. However, people experience hardship within a local context. Already today, an unpredictable and harsh climate in combination with difficult social conditions, uncertain tenure and other factors, force many to seek a livelihood elsewhere. People who move from one place to another often encounter much harsher climatic conditions to which they are not accustomed. The more productive land is, naturally, already occupied in most areas. Most migrants end up in burgeoning cities and invariably in congested areas with difficult living conditions. Virtually the entire projected population increase of some 3 billion people during the first half of this century is predicted to occur in urban and peri-urban areas.

To meet the new challenges of increasing climate variability and change, countries need to develop national strategies on climate adaptation and climate variability. For instance, there has been a strong call for strategic planning to reduce the impacts of floods and droughts, which are likely to be more dramatic in the future. Coordinated action at a regional level

is important. Strategies should focus on reducing vulnerability. Examples may include loan schemes to finance counter measures or extension services that demonstrate promising examples of integrated land and water management.

Looking ahead, water for food production will have to compete with other kinds of water and land use.

Trends indicate that interest from policy makers, producers and consumers in bioenergy and other commercial agricultural commodities will continue to grow. There is a need to find out how farmers, in particular small farmers, may benefit from or be affected by changes in demand for agricultural commodities. Food security is thus not the only issue in determining water resources management and allocation.

In any case, the additional pressure on water from large-scale cultivation of biomass for energy purposes will be considerable. This pressure will need to be evaluated in the contexts of climate change as well as social factors. It is relevant to mention that water stored in reservoirs may be used for irrigation and urban supplies but also to produce hydropower. Since the land and water used for energy purposes in many cases could have been used to produce food, increased competition for scarce resources is inevitable. Governments need to consider all options for how to deal with the demands for food and energy while protecting ecosystems.

Balancing demands and dealing with tradeoffs

Like any security concept, drainage basin security must address the questions: for what purpose and in what time perspective? Competition for water resources is intensifying in many areas around the world and among a diverse range of users. Household water and sanitation services are the most basic and daily human need. If these services are not provided, human health and well-being will be affected. Increasingly influential users are industry and cities. The largest appropriation of freshwater resources is, however, for food and other agricultural production. Furthermore, the global dietary trend of an accelerating demand for animal products such as meat, milk, fish, or eggs is causing a notable increase in water requirements.

In agricultural ecosystems, water requirements depend on the growing season of the crops. If water is not available when the crops need it, the crops fail.

Photo: Mats Lannerstad

Onsite water conservation is one way to deal with water shortages. In a location with high potential evapotranspiration and where most rain falls in one part of the year, it is essential to conserve water for other parts of the year and continue to supply water to households, industry and other users.

Compared to the water requirements in agriculture, water for industry and other urban activities is comparatively modest. Thanks to technological advances and the fact that water is generally contained in pipes and machinery, evaporation and transpiration is not an issue in industrial water use. Impacts on water quality may, however, be significant with consequences for the recipients and downstream water users. Pollution, contamination, and unsanitary conditions will hamper the economic health of a basin just as surely as they will diminish human health. At the same time, many industries and service activities cannot function without ample amounts of clean water.

"Household water and sanitation services are the most basic and daily human need"

The environment is also a user of water. If rivers, wetlands, floodplains, deltas and aquifers do not receive enough good quality water at the right times the health of these systems is affected. This in turn affects the generation of ecosystem goods and services on which people depend. Impacts on freshwater and riparian ecosystems and biodiversity have been widely documented and it is increasingly recognised that including the environment as a user is essential when making decisions on how water is managed and allocated. Fragmentation of rivers and excessive withdrawal of water have led to the recognition that a proportion of river flow must be reserved for environmental purposes, in much the same way that a certain amount of water must be reserved for basic human needs. It is not only the amount of water reserved, but also the timing and frequency of flows that is important to protect vital ecosystem functions. Downstream communities dependent on seasonal flooding for floodplain agriculture and fishing communities in river deltas are just two examples that show how human activities and well-being are dependent on healthy functioning freshwater ecosystems.

Catering to multiple and growing demands and aiming for a fair and equitable allocation are, however, not only a matter of augmenting the resource. If each unit of the available water is more efficiently used, the result is comparable with conservation of the resource. High water productivity in industrial as well as agricultural production makes it possible to reach more users with a given water resource while aggregate production or benefits may increase.

The good and bad of wastewater

Productivity and the possibilities of a continued use of water and land must also be related to pollution. Intensified use of water and land naturally has an impact on water and environmental quality. Use of chemicals is growing with increased problems related to carcinogenic micro-pollutants and endocrine disrupters, many of which are found in water bodies. Treatment plants will not contain these substances. It is therefore necessary to develop systems to contain or neutralise the effects of hazardous substances. Attention is needed to the fact that the response time involved in water pollution abatement may be extremely long due to delays in societal awareness raising and decision-making. It also takes significant time for the pollutants to be flushed out of the water system.

The notion of wastewater is, however, also misleading. If the 'waste' consists of nutrients, such as nitrogen and phosphorus, that 'waste' is an essential resource. Using such water for agricultural production will be essential not only from a production, environmental and water resource perspective. It will help to prevent pollution and eutrophication, and also help to reduce the exploitation of finite resources, notably phosphorous. The geologic deposits of phosphorus are finite, with stocks estimated to last for not much more than 50 years at present production levels. Phosphorus leaves the food chain mainly through urine. Recycling of nutrients may be an essential part of strategies to safeguard food security for future generations.

Balancing interests and weighing options involve delicate decisions and must be seen as a political process. Strong political leadership is needed in order to effectively manage competition and resolve conflicts over water between, among others:

- urban and rural needs;
- upstream and downstream users;
- humans and ecosystems; and
- different economic interests.

Sharing of benefits is rational water and development policy

Poor correspondence between the physical basin, political territories and human development

Water experts define the physical drainage basin as the natural unit and framework for water and land management. Clearly, socio-economic and political systems are not and will likely never be confined within these geographical boundaries. Since other planning processes are organised within political and administrative borders, political decisions to develop certain regions or improve livelihoods for people will be a mixture of national and local sector policies and the best possible development and stewardship of water and other natural resources. The national level is a key for strategic and long-term water policy for domestic as well as transboundary cooperation. Water experts must provide recommendations for policy and management that fit basin dynamics and socioeconomic development objectives as well as political and administrative contexts.

A policy for sharing of benefits from water development and use

The concept of benefit sharing offers avenues for thinking and implementing polices that recognise basin development potential by going beyond the physical drainage basin. The main idea of the benefit sharing paradigm is that one should not only think about how one could divide and share the water resources *per se*, but rather how one could share the benefits that may be derived from optimal development and use of the resources in a basin. This necessitates a look at issues that are outside of the visible, physical blue water box. Although the discourse has developed, better knowledge about the potential to increase aggregate benefits and strategies for how to share them are needed. In many basins, water flow is the most tangible and valuable aspect, but the benefits that can be derived from its use are not always uncertain. Policies for sharing of benefits must therefore be linked to responsibilities, investments and initiatives to generate benefits across the basin. Often, development in one part of

Photo: Anton Earle, SIWI

the basin is related to interventions – or the lack of them – in other parts. Schemes, for instance, may be needed to compensate upstream inhabitants for land and water management practices that promote maintenance and enhancement of downstream water or ecosystems services.

It is important to remember the relationship between food security and trade. At least half of the world's population lives in urban areas and has access to food that is not produced in the area where they live. Currently, less than 20 percent of food is traded internationally, but with urbanisation and structural changes of the economies, trade is increasing domestically and internationally. Many water short countries have alleviated their resource handicap and benefitted from imported, highly subsidised food from the temperate regions. On the other hand, subsidies in the North reduce the incentive to increase domestic production in poor communities, although there may be a potential to do so. Food exports and imports in combination with market distortions may thus relieve the burden on some countries to be food self-sufficient but place the weak and non-diversified economies in the South in a vulnerable situation.

The idea to share benefits is new and may be hard to grasp and to translate into policy and concrete action. To a large degree it hinges on the willingness and ability of political and opinion leaders to build mutual trust across borders. One party must believe that the other parties will work for common goals. There must be a belief that policies also outside the water sector can be fair and lead to a better future if they are jointly developed and executed across national territories. For this to happen it is imperative that win-win solutions are identified at the basin level thus creating incentives for all parties to cooperate.

A number of obstacles to effective management of transboundary waters exist today. National states have naturally played a prominent role in social and natural resources development planning. Upstream countries, in particular, tend to perceive comprehensive cooperation as being too risky; they do not want to negotiate away future water uses.

In many basins, *realpolitik* and zero-sum mentality ('what you gain, I'll lose') still dominate. Indeed, the potential of international law and international collaboration needs to be assessed. Unfortunately, the power of the hegemons in a basin to "get their way" at the expense of the weak is evident, and regional institutions are often impotent in overcoming political obstacles due to national considerations. World Water Week discussions have repeatedly shown how hydro-hegemons can shape the nature of interaction – for unilateral or collective good. Efforts to delink water

Photo: Mats Lannerstad

from the overall political situation is, however, futile. Rather, one could, and indeed should, make use of the potential unifying power that a transboundary water resource development provides to increase and share the benefits, deepen dialogue, and thereby assist in economic development.

Transboundary water governance requires rules and regulations, but to invoke legitimacy and ownership, intrinsic and subjective values need to be understood and accommodated in the process. We need to develop incentives that encourage riparian countries to reach agreements, using the linkages between water and other sectors of society (trade, energy, transport, etc.). Cross-sector water use is also a critical policy issue. For example, how can we better link water supply and sanitation strategies to agricultural water and nutrient use?

Weak social and economic dimensions in water governance

It is often argued that water governance and various management tasks will change more in the coming decades as compared to what has been the case during the last several centuries. No doubt, new dimensions are continually being added to the water agenda. The water sector is currently subject to reform and increasing political attention. While technical aspects remain of crucial importance, the social, financial and economic dimensions have become significant features in water governance. Institutional arrangements are key, as is the more active involvement of representatives of civic society, including water users (usually referred to as stakeholders), the research community, media and communication. The list of relevant actors can be quite long, which certainly will lead to formidable difficulties of communication. How to associate involvement with accountability requires a fresh approach and effective measures.

The "add-on" of women in water policy?

In many countries it is politically correct to pay lip service to gender considerations these days, but it is often an "add on" engagement. Males typically dominate senior positions in water policy making. The point in gender discussion is not about the quality of work and how it is performed, but the adequacy of representation. By having a wider representation in policy making, additional experiences and values are likely to be included in the formulation. Interesting examples have been presented about the social links to the young generation and also sectors of the economy, which in many countries reflect a division between males and females. Garden agriculture, with important crops from a nutritional point of view tends to be run by females. Generally, females play a very important role in agriculture in general while they tend to have little say about irrigation. Responsibility to the next generation, to our children and grandchildren is a vital sustainability aspect that should be reflected in strategic decision-making processes concerning contemporary and inter-generational issues.

"We will organise a meeting to decide about water projects for our community and we have called farmers, fishermen, industrial representatives… and a few women…"

Illuminating stories have been told about how meetings are arranged: "We will organise a meeting to decide about water projects for our community and we have called farmers, fishermen, industrial representatives… and a few women…". Concrete measures that could be taken to get away from the "add on gender aspect" include gender sensitive budgeting, education

and involvement of youth, mentoring, and making partnerships effective in achieving the goal of gender mainstreaming.

This is all part of a wider weakness in water policy and development, namely the failure to take the human behavioural component seriously. Focus is often on "institutions" and technical solutions, as if these arrangements *per se* did the job. The role of individuals and the importance of attitudes, motivation and reflection have largely been missing in the water and environment debate. Visionary, courageous and innovative leaders and opinion makers are needed in institutions and organisations, nationally and locally, and on their own in order to make the slogan of "water is everybody's business" a reality. People's behaviour and their surrounding structures are important to policy formulation and to discuss and define what is possible. This is literally a "deep sea" issue, which is sensitive and hard to grasp. Working with attitudes that promote accountability, performance and innovations is important.

"Decision-makers need to be convinced that investment in water, sanitation and sound water resources management drives economic growth, social development and political stability."

Economic incentives and instruments

The application of economic instruments (charges, subsidies, taxes, quotas, ownership rights, water use rights, and trading options) is common in the water sector, both for water supply and services, and for management of the water resource. Sometimes the economic instruments are applied in a transparent manner, but more often not. They can be very effective instruments in steering both providers of services and users of water into more or less sustainable operations and practices. Subsidies are the most widely used economic instrument in the water sector. Whereas subsidies have brought various social benefits, side effects such as inefficient water use, depletion of the resource and environmental impact have become major concerns. It is important that the design of all types of economic instruments contribute to the clarification of responsibilities, increases the water use efficiency and allows for increased cost recovery for the operation and maintenance of household water supply, irrigation and other related infrastructure. The bottlenecks are typically related to institutional and political issues such as regulation, monitoring, social and political acceptance, and community involvement. Potential efficiency gains for applying economic instruments are conditional on correct pricing and robust institutional control and concern about negative distributional effects for weak segments in society.

An important but largely neglected distinction in the economic instruments discourse is between the modern economic sector and the traditional societies which include subsistence farmers, fishing communities, and marginalised people (landless and urban slum dwellers). Introducing financial and economic instruments to the basic functions of traditional livelihoods (which often consider water as a common resource) is a delicate process and should be done with the simultaneous introduction of financial systems such as micro-financing or insurance systems. The emergence of new types of economic instruments is closely linked to the development of a number of tools and approaches for analysing the effects of economic policies, such as multistakeholder cost-benefit analysis and hydro-economic models. The field of economic instruments is in rapid evolution and it is expected to undergo much progress with trials, errors and successes in coming years.

Financing

For efficient water development, water use and safe disposal of water after use, a combination of institutional arrangements and human and financial resources is required. There is wide consensus that investment requirements in the water sector amounts to billions of dollars annually, and that so far, the funding is substantially lower than needed. Investment requirements in physical structures can refer to new structures, but more often they refer to operation and maintenance, and payment for the replacement or upgrading of existing schemes. Many existing schemes are old or are not designed for a climate change scenario. The World Business Council for Sustainable Development, for instance, estimates that total costs of replacing ageing water supply and sanitation infrastructure in industrial countries alone may be as high as USD 200 billion a year.[2]

Photo: Frida Lanshammar

Financial resources needed to build and maintain dams and conveyance systems for irrigation supplies are similarly enormous. Many sources reduced their financial commitment in the period after the 1970s. For instance, World Bank lending peaked in 1977-1979 and has been reduced from USD 2 billion per year to about USD 0.2 billion per year.

Financing infrastructure will require new public-private partnership models which build on the domestic financial community, capital markets, industry, technology companies, local communities and government agencies at local, regional and national levels.

Costs of and reasons for inaction

An intriguing question throughout the World Water Weeks has been: in spite of all this, how is it that concrete action is still lagging and that professionalism, follow-up and dedication is often missing? What are the reasons for inaction or poor performance in spite of the fact that the job is labelled "complete" and huge amounts of money have been spent? Water supply for basic human needs and programmes to close the sanitation gaps are cases in point. Numerous calculations have shown that it is more costly not to invest in sanitation even if construction and institutional arrangements initially may require substantial budgetary resources.

Decision-makers need to be convinced that investment in water, sanitation and sound water resources management drives economic growth, social development and political stability. Water services at individual and community levels are linked to macro-economic development and to the capacity of countries to eradicate poverty and sustain development. Despite this, water's cross-cutting aspects are rarely considered.

From time to time, the enormous challenges are addressed on a grand scale, such as in connection with the International Decade of Drinking Water Supply and Sanitation and the ongoing Millennium Development Goals (MDGs). Construction of water supply and sanitation schemes, for instance, is given a boost but the necessary parallel investments in training and human resources development to run and maintain the technical solutions and/or dealing with the relation to the users and beneficiaries are given less weight. Experiences in the 1970s and 1980s have shown that investments are often wasted if not accompanied by intensive capacity building efforts to train individuals and organisations to maintain, upkeep and manage the systems. Targets like the MDGs are important to mobilise resources and give a direction and purpose to objectives. Whether or to what extent they will be reached obviously depends on many circumstances, but

[2] WBCSD. 2005. Water Facts and Trends. World Business Council on Sustainable Development. Washington DC. Referred to in: UN World Water Development Report, 2009. Water in a Changing World. UNESCO Publishing, Earthscan

it is essential to assess how the interplay and synergy of technical structures, institutional arrangements and human resources development and involvement have developed and how to improve this interplay.

Dealing with creeping and invisible environmental change

The question of action and inaction is delicate in cases of slow processes that lead to both progress and problems. Intriguing examples have been presented that highlight a gradual accumulation of toxic substances in water bodies and in the environment. Some six million chemicals are used in human activities, benefitting but also exposing humans and ecosystems to their effects. A tiny fraction (a few thousand) are shown to have deleterious effects while the unknowns and potentially dangerous are most common. The use and spread of these substances are, of course, based on a belief that they will help the users to accomplish something desirable. But action to reduce, contain or halt the negative processes is generally weak and typically in the form of reactions, when damage is not only obvious but after it has been proven. We have a fairly good knowledge about numbers and amounts of chemicals and also strong indicators of their health implications. With the best possible calculations that can be made today it can be shown that the cost of inaction is much larger than the cost to come to grips with the water pollution problem. There are counter arguments to show that the issues are extremely complex and that calculations about risks and benefits may need refinement. The conclusion coming out of these debates is that concerns have to be taken seriously and the precautionary principle must be a guiding principle.

Photo: Getty Images

Reasonable control

Planning for an acceptable level of security of expanding human activities with reference to finite and highly variable freshwater resources and vulnerable ecosystems constitutes the most basic, intricate and fascinating governance challenges now and in years to come, for the individual, locally, nationally and internationally.

The enormous complexity and variability of society-water resources systems cannot be handled at one level and through monolithic institutions. Central government and development agencies' approaches need to be linked to stakeholder-based, bottom-up approaches to participation. Local action plans must be linked to and be in harmony with national and international plans, including investments, physical interventions, human resources development and monitoring.

Formal decision-makers have limited resources, and should not attempt to strictly control complex systems. Decision-makers tend to expect that scientists can provide fixed answers about what to do and what will be the outcome of a proposed intervention. However, strategies that attempt to exercise strict control over dynamic processes, like interaction between water and human activities are doomed to fail. The outcome from a large number of workshops, seminars and informal talks in corridors has converged on the conviction that the task is to provide support to decision-makers and managers that allows them to establish *a reasonable amount of control* over the forces affecting drainage basin security.

Both biophysical and social and political systems are highly dynamic and the relation between human action or interventions and their outcomes is usually

not possible to predict with certainty. Governance has to include rules of the game and secure a system based on harmony and overarching goals. A systems perspective is an essential base for coordinated activities. Public participation – involving equitable actors with reasonable insights – is essential to secure social acceptance of water allocation, conservation and protection decisions.

Civil society

Involving civil society in water policy means involving a number of representatives from important stakeholder groups in the process of formulation and design of plans and institutional activities. This premise has been recognised for decades. In practice, it is a very complex issue, since it potentially involves a combination of numerous actors, such as water and land users, small and big farmers, upstream and downstream representatives, men and women, technical professionals, governance officials, investors, and entrepreneurs. Gradually, experiences have added new dimensions to this strategy and highlighted practical and organisational difficulties and social and political dilemmas. Bringing all categories of users into meaningful dialogues is a process for which there are few blueprints.

Flexibility is essential to build and retain reasonable control and to secure compatibility between human activities and healthy ecosystems. Attention will have to be paid to possible changes in hydrological preconditions linked to climate variability and change, and to impacts of altered land use.

One of the issues that is now discussed is compensation of upstream inhabitants for land management that promotes maintenance and enhancement of downstream ecosystem services. Compensation may be used proactively not only for restoration of degraded ecosystems but also for conservation of existing ones. The nature of compensation can be quite varied, for example, through payments, soft credits and certification. If people in upstream areas are asked to refrain from doing things that earn income for them, there

Photo: Michael Moore, SIWI

is likely to be poor compliance and conflicts if they are not compensated. But who shall cover the compensation? The people in downstream areas who are supposed to benefit or should the government spend tax payers' money on this? Hence, the distribution of compensation benefits is a highly challenging task. Processes for negotiating and iterative approaches have proved necessary for successful outcomes.

IWRM – Is integration only about water?

The preceding sections in this section have dealt with the *how*, *who* and partly the *why* questions. Considerable discussions have also been focussed on the *what* questions during the niche period. Integrated Water Resources Management (IWRM) is a debated approach in water policy. It sets out to be an essential mechanism for development and does have a role to play in drainage basin security.

An essential characteristic of IWRM is the coordination and balancing of activities. The confusion and critical views that surround the concept and ambivalent initiatives to specify what it entails and to translate it into concrete plans in many countries may be an example of the lack of conceptual refinement and clarity. An increased complexity and variety of water-related challenges call for an integrated or coordinated approach, but due to these very processes, it is becoming more difficult to specify what integration entails, what it means, and how it can be implemented.

The IWRM acronym highlights water. Texts explaining the concept show that integration is wider than water. As emphasised earlier, water cannot be seen in isolation from other landscape elements. Proper management of freshwater resources must be based on the coordinated management of water and other components of the biophysical system. Land and soil management is particularly important. Blue/green water interactions and water partitioning are closely linked to land use. Drainage basin security calls for an incorporation of land use as well as protection of vital ecosystems into a catchment-based IWRM, turning it into ILWRM, where L stands for land use. Such management has to include a compatibility analysis of different activities and functioning ecosystems.

IWRM plans may be seen as "road maps" to show what programmes and activities that are likely to lead to a sustainable use of the resource base and to meet social and political objectives of equity, inclusion and stability. As such, the IWRM plans have to be linked appropriately to national level economic planning.

Towards 2015 and Beyond

Significant challenges on a massive scale characterise the interplay between biophysical and human systems. And they are bound to become even more pronounced. From the individual to communities and ultimately the global population, the dependence on water is a fact of life and livelihood. The eight Millennium Development Goals, which are supposed to be achieved by 2015, are all directly or indirectly related to water. As seen from all those who are poor, hungry, and who witness or suffer premature death and destitution, the goals are at best modest. They have heard much of similar pledges before. In practice, the MDGs represent extremely difficult tasks: to reduce, by half, poverty and hunger within a fifteen year period. They do illuminate the association between the security and functioning of drainage basins and livelihoods.

With increasing demands on water, the demand will also increase for better institutional arrangements and substantial investments. Strategies and commitments to poverty alleviation and social equity require that services are provided even if cost recovery may be hard to effectuate in each and every community. A delicate task is to ensure that water services are available at acceptable fees irrespective of socioeconomic status of communities. Meeting the basic water needs of the poor is in the interest of macro-economic progress and political stability.

Crucial tasks for the future are to try to foresee what may come and anticipate the consequences of different policies and human efforts. Dealing with concrete and urgent problems will continue to be vital. But we cannot escape from the pressing need to promote imaginative thinking about the future. In short, a combination of specialised skills and multidisciplinary and anticipatory approaches are required. Links to political decision-making are a pre-requisite for science to contribute to development.

Progression in society is often a result of human ingenuity interacting with natural resources. In any society a balancing between different interests and demands has to be performed by politicians. To a larger or lesser extent politicians are informed by research and they must consider the views and accumulated wisdom embedded in civic society. Practical and theoretical knowledge applicable to new circumstances must be translated into education, training and communication programmes. Communication between representatives of the scientific community, policy makers and the public is essential.

Apart from, and in addition to, a number of tangible tasks and building of institutions and organisations, it is essential to cope with the gaps between perceptions, human ambition and the dynamics of biophysical systems. Concepts must mirror real problems and opportunities. To facilitate stakeholder participation, it will be essential that perceptions and divergent interpretations of key concepts are given due attention.

Photo: Jakob Granit, SIWI

Drainage Basin Security

Prospects for Trade-offs and Benefit Sharing in a Globalised World

The World Water Week in Stockholm is the leading annual global meeting place for capacity-building, partnership-building and follow-up on the implementation of international processes in water and development. Future-oriented, interdisciplinary and intersectoral, the World Water Week brings together experts from government, research, business, intergovernmental agencies, non-governmental organisations, civil society and United Nations agencies. Each year, the World Water Week addresses a theme that fits within a broader niche. This report looks back over the niche on Drainage Basin Security, which 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.

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