Water Security & the Global Water Agenda

A UN-Water Analytical Brief

UN WATER

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Copy-editing: Tim Lougheed

Acknowledgements

Table of Contents

Foreword

It is fitting that the topic of water security, through the launch of this Analytical Brief, figures among the many celebrations marking the 20th anniversary of World Water Day on 22 March 2013 and the 2013 International Year of Water Coopera- tion. In recent years, the issue of water security has been gaining traction in the global political agenda and earning atten- tion from national governments at the highest level, in particular for its links to peace and national security, but also for its implications for development issues.

Several recent events and discussions have highlighted these links between water security and international peace; most notably, the High-Level Roundtable Discussion on Water, Peace and Security jointly hosted by the United States, the European Union and UN-Water that took place during the 67th Session of the United Nations General Assembly in September 2012[1]. As highlighted by then U.S. Secretary of State Hillary Clinton, water security is key for ensuring peace and security, but also for human development. Secretary Clinton highlighted that water security offers opportunities: for cooperation, collaboration, and for addressing challenges in a multi-disciplinary and cross-sectoral way in order to reduce risks for potential conflicts and manage continued sustainable development and growth.

With this Analytical Brief, UN-Water aims to provide a starting point for discussion on the range of issues that collectively fall under the umbrella of water security, identifying the challenges that lay ahead, the necessity of relating water security to policy development, and offering possible options for responding to these challenges. It underlines the important role that cooperation will play in addressing water security challenges, including collaboration between different stakeholders and across all levels, from local to international. The collaborative nature of UN-Water Members and Partners on the Analytical Brief sets an example for cooperation across the UN System for addressing the shared challenges of water security.

The production of this Analytical Brief on water security is timely as the international community prepares for a post-2015 development world through the development of the Sustainable Development Goals (SDGs). To this end, this Analytical Brief provides an important input into the discussion on the possible inclusion of an SDG on water, a process to which UN-Water is actively contributing.

It is my hope that the ideas outlined here will serve to stimulate further discussion on water security and underscore the importance of water security in addressing a multitude of challenges: from health to education, industry to ecosystems, human rights to economic development and growth; among so many others. This Analytical Brief offers one step towards ensuring that water continues to be included amongst our top development priorities as we move beyond 2015.

Mr. Michel Jarraud
UN-Water Chair
22 March, 2013

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[1] A webcast of the event is available at: http://webtv.un.org/watch/roundtable-on-water-peace-and-security/1861036435001/.

Summary for Decision-Makers

This Analytical Brief serves as a starting point for dialogue on water security in the United Nations system. This Brief offers a working definition of water security developed from contributions made by the broad range of organizations, agencies, programmes and institutions that form UN-Water. Through this Brief, UN-Water aims to capture the constantly evolving dimensions of water-related issues, offering a holistic outlook on challenges under the umbrella of water security. It highlights the main challenges to be addressed, the role water security plays in policy agendas, and possible options for addressing water security challenges.

A working definition of water security provides a common framework for collaboration across the UN system. Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. This shared definition will facilitate the work of UN-Water and its Members and Partners.

Water security encapsulates complex and interconnected challenges and highlights water's centrality for achieving a larger sense of security, sustainability, development and human well-being. Many factors contribute to water security, ranging from biophysical to infrastructural, institutional, political, social and financial – many of which lie outside the water realm. In this respect, water security lies at the centre of many security areas, each of which is intricately linked to water. Addressing this goal therefore requires interdisciplinary collaboration across sectors, communities and political borders, so that the competition or potential conflicts over water resources, between sectors and between water users or states, is adequately managed. In recognition of its security implications on tensions and conflicts, UN-Water supports the inclusion of water security on the agenda of the UN Security Council.

Water security needs to be included in the formulation of the Sustainable Development Goals (SDGs). The SDG process must incorporate a goal and related targets for achieving water security, as this will address multiple priority development areas under consideration: conflict and fragility; environmental sustainability; growth and employment; health, hunger, food and nutrition; inequities; energy; and of course, water. It is safe to state that investment in water security is a long-term pay-off for human development and economic growth, with immediate visible short-term gains.

Recognition of the human right to safe drinking water and sanitation by the United Nations General Assembly and the UN Human Rights Council is an important step towards ensuring water security at the individual and community levels. The UN resolution on the human right to water and sanitation is a catalyst for further policy discussion between stakeholders and across sectors, and in the development of programmes that make possible the full realization of the rights of individuals and communities. A human rights-based approach to water security addresses critical gaps and bottlenecks, and emphasizes the establishment of regulatory functions and mechanisms for efficiency, participation and accountability.

Innovative financial mechanisms need to be promoted that contribute towards the goal of achieving water security through a supportive policy environment. Traditionally, most of the financing for initiatives that help to achieve water security have come from the public sector. New and innovative sources of financing require a policy arena conducive to ensuring that investments are protected and can provide secure options for financing in the long term. Options include investments from the private sector, micro-financing schemes, particularly with local communities, and other innovative options for funding (e.g. crowdsourcing).

Successful transboundary water security can stimulate regional cooperation. Transboundary waters pose enormous challenges for achieving water security in systems, such as river or lake basins and aquifers, which are shared across political boundaries. In such cases, water-related challenges are compounded by the need to ensure coordination and dialogue between sovereign states, each with its own set of varied and sometimes competing interests. Numerous examples from across the globe demonstrate that shared waters provide opportunities for cooperation across nations and support political dialogue on broader issues such as regional economic integration, environmental conservation, and sustainable development. It is important to ensure that water security is achieved for all users, whether up- or downstream, and does not come at the expense of water insecurity for some.

Good water governance is essential to achieving water security, and requires well-designed and empowered institutions with supporting legislative and policy instruments. Achieving water security requires institutional, legal and regulatory support and capacity for change, adaptive management structures, new forms of relationships, and multi-layered models capable of integrating complex natural and social dimensions. Governance structures must be adapted to local conditions and needs, applied at various levels so that they mutually reinforce and complement one another.

In conflict and disaster zones, threats to water security increase through inequitable and difficult access to water supply and related services, which may aggravate existing social fragility, tensions, violence, and conflict. Water security is precarious in conflict and disaster zones, and threats to water security are manifested through negative impacts on water resources and related ecosystems, both in quantity and quality. Conflicts and disasters can have cascading effects and far-reaching implications on water security, with political, social, economic and environmental consequences. Water security must be addressed as a first step in the aftermath of conflicts and disaster in order to restore livelihoods and revive social and economic development.

Water security will be compromised by the consequences of climate change, as the vast majority of its impacts will be on the water cycle, resulting in higher climatic and hydrological variability, with important consequences for societies. These effects on water security will differ regionally and will depend upon a number of factors, including geographic location and features, conditions of water availability and utilization, demographic changes, existing management and allocation systems, legal frameworks for water management, existing governance structures and institutions, and the resilience of ecosystems. Changes in the hydrological cycle will threaten existing water infrastructure, making societies more vulnerable to extreme water-related events and resulting in increased insecurity.

Ensuring that ecosystems are protected and conserved is central to achieving water security – both for people and for nature. Ecosystems are vital to sustaining the quantity and quality of water available within a watershed, on which both nature and people rely. Maintaining the integrity of ecosystems is essential for supporting the diverse needs of humans, including domestic, agricultural, energy and industrial water use, and for the sustainability of ecosystems, including protecting the water-provisioning services they provide.

Policy-makers need to identify existing capacities, as well as gaps, in order to properly address the water security challenge. Capacity development is a long-term process based on incentives, good governance, leadership, and knowledge management and transfer, which need to be continuously adapted according to stakeholders' feedback and needs. The UN-system, and in particular UN-Water, can address gaps in capacity by emphasizing collaboration amongst agencies; fostering trans-sectoral coordination at the national level by encouraging the sharing of and access to capacity development resources; providing water education and training to support institutional challenges; and establishing a knowledge community to address water security challenges.

Water security can only be achieved if it is supported by an enabling environment that establishes systemic and cross-cutting changes, including integrated policies targeting synergies across sectors, while managing the demand for water by all users and stakeholders. Efforts to achieve water security through multi-sectoral, coordinated policies and inter-disciplinary approaches will have multiple positive effects by addressing water challenges holistically, taking into account the needs of various sectors, such as energy and agriculture, that will require increasing water resources to satisfy population growth and growing demands. Such an environment will reflect the interconnectedness between sectors while respecting the needs for water by individuals and communities.

Section 1

A Working Definition of Water Security[1]

This Analytical Brief serves as a starting point for dialogue on water security in the United Nations system. The working definition of water security offered here was developed from contributions made by the broad range of organizations, agencies, programmes and institutions that form UN-Water. This Brief aims to capture the dynamic and constantly evolving dimensions of water and water-related issues, offering a holistic outlook for addressing water challenges under the umbrella of water security.

Water security is defined here as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being[2], and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability[3]. This definition implies that water is managed sustainably throughout the water cycle and is done so through an inter-disciplinary focus, so that it contributes to socio-economic development and reinforces societal resilience to environmental impacts and water-borne diseases without compromising the present and future health of populations and ecosystems. Achieving water security requires allocation among users to be fair, efficient and transparent; that water to satisfy basic human needs is accessible to all at an affordable cost to the user; that water throughout the water cycle is collected and treated to prevent pollution and disease; and that fair, accessible and effective mechanisms exist to manage or address disputes or conflicts that may arise. The concept operates at all levels, from individual, household and community, to local, sub-national, national, regional and international settings, and takes into account the variability of water availability over time.

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[1] In addition to the main contributors, this section has benefitted from a rich email discussion between UN-Water Members and Partners on the definition of the term "water security", with additional comments provided by: AIDA, FAO, GWP, IAH, IUCN, UNDP, UNESCAP, UNESCWA, WWF.

[2] Human well-being has multiple constituents, including basic material for a good life, freedom of choice and action, health, good social relations, and security (MA, 2003).

[3] This definition of water security is based on the one provided in UNESCO's International Hydrological Programme's (IHP) Strategic Plan of the Eighth Phase (see UNESCO-IHP, 2012a), endorsed at the 20th Session of the UNESCO-IHP Intergovernmental Council (UNESCO-IHP, 2012b: Resolution XX-5).

The term "water security" offers a common framework and a platform for communication, and will facilitate the work of UN-Water and its Members and Partners. Various definitions and interpretations of the term "water security" exist (cf. UNESCO-IHP, 2012; GTZ, 2010; Grey and Sadoff, 2007), and use of the term is widespread both within and outside the UN system, whether defined or not. A mutually agreed-upon definition, especially across the UN system, is needed if water security is to be achieved, and provides a shared understanding of the concept and its various complex dimensions. The UN-Water working definition of water security provides a common platform that consolidates the views and approaches across the UN system, and provides a focal point for enhanced collaboration among UN-Water Members and Partners.

A common working definition of water security will facilitate the incorporation of water security issues in the international development dialogue, particularly in the formulation of Sustainable Development Goals (SDGs). Uncertainties about the definition of "water security" restrict the use of the term in the context of international, regional, and national processes and the UN's development work. This potentially places water issues at a disadvantage when compared to other interests, such as food security or energy security, in similar forums. In such settings, more effort will be required to articulate water issues, often in more complicated and incomplete ways. A common working definition will serve to encapsulate the topic succinctly, thereby strengthening communication, and improving the coordination, formulation and achievement of common sustainable development goals – challenges this Analytical Brief seeks to address.

Box 1: Key Aspects of Water Security

The discourse on water security in recent years contains a number of common, key elements to water security. Below is a summary of the core elements necessary to achieving and maintaining water security, as found in a broad range of published definitions:

- Access to safe and sufficient drinking water at an affordable cost in order to meet basic needs, which includes sanitation and hygiene (cf. United Nations General Assembly, 2010), and the safeguarding of health and well-being;

- Protection of livelihoods, human rights, and cultural and recreational values;

- Preservation and protection of ecosystems in water allocation and management systems in order to maintain their ability to deliver and sustain the functioning of essential ecosystem services;

- Water supplies for socio-economic development and activities (such as energy, transport, industry, tourism);

- Collection and treatment of used water to protect human life and the environment from pollution;

- Collaborative approaches to transboundary water resources management within and between countries to promote freshwater sustainability and cooperation;

- The ability to cope with uncertainties and risks of water-related hazards, such as floods, droughts and pollution, among others; and,

- Good governance and accountability, and the due consideration of the interests of all stakeholders through: appropriate and effective legal regimes; transparent, participatory and accountable institutions; properly planned, operated and maintained infrastructure; and capacity development.

Sources: Adapted from the UN-Water Concept Note "Water Security – A Working Definition" [internal document, 4th Draft, 2011] and the Ministerial Declaration of The Hague on Water Security in the 21st Century, Second World Water Forum, 22 March, 2000.

The term water security captures the dynamic dimensions of water and water-related issues and offers a holistic outlook for addressing water challenges. While some definitions of water security have a narrow focus, representing specific interests, many others attempt to capture the various dimensions of the term (see Box 1). Approaching water issues under the umbrella of water security captures most interests in water and offers a means for considering these issues holistically, as many issues are closely interrelated and have multiple causes, impacts, and solutions across sectors.

Water security encapsulates complex and interconnected challenges and highlights water's centrality for achieving a sense of security, sustainability, development and human well-being, from the local to the international level. Many factors contribute to water security and range from biophysical to infrastructural, institutional, political, social and financial – many of which lie outside the water realm. Water security, therefore, lies at the centre of many security areas, each of which is intricately linked to water (Zeitoun, 2011). Addressing water security, therefore, requires interdisciplinary collaboration across sectors, communities and political borders, so that the potential for competition or conflicts over water resources, between sectors and between water users or states, is adequately managed (Wouters *et al.*, 2009).

Section 2
Themes for Further Dialogue

This section outlines the broad concepts for understanding water issues within the context of security. It establishes the link between water and human security issues, and highlights how water insecurity can lead to fragile and vulnerable societies. It points to the importance of the role of water in transboundary contexts, whether for cooperation, or in tensions or instability, and serves to stimulate the research and policy communities to address water security challenges.

2A. The Relationship between Water and Human Security

Water issues must be placed within the existing paradigm of human security. In the past few decades, definitions of security have moved beyond a limited focus on military risks and conflicts and have broadened to encompass a wide range of threats to security, with a particular focus on human security and its achievement through development (UNDP, 1994; Leb and Wouters, 2013). Water is best placed within this broader definition

of security and acts as a central link across the range of securities, including political, health, economic, personal, food, energy, and environmental, among others (cf. Zeitoun, 2011).

Water is a multi-dimensional issue and a prerequisite for achieving human security, from the individual to the international level. A number of individual securities must be met in order to achieve human security: a good level of health and well-being, adequate and safe food, a secure and healthy environment, means to a secure livelihood, and protection and fulfillment of fundamental rights and liberties, among others (see e.g. UNDP, 1994). Water is required for ensuring these securities are met, from access to water supply at the individual or community level, to the peaceful sharing and management of transboundary water resources across political boundaries (cf. Ministerial Declaration of The Hague on Water Security in the 21st Century). Human security is dependent on an individual's sense and level of well-being, with these being closely tied to the individual's need for water and the benefits it provides. Water security can therefore reduce the potential

for conflicts and tensions, contributing to significant social, development, economic and environmental benefits on a larger scale, as well as to the realization of states' international obligations.

Improper disposal of Industrial waste

In developing countries,

70%

of industrial wastes are dumped untreated into waters where they pollute the usable water supply.

Source: World Water Assessment Programme (WWAP)

Addressing the multiple challenges of water security will reduce the risks, threats and vulnerabilities associated with human security and contribute to a more secure future. A number of important global drivers are significantly affecting water resources, increasing the risks and vulnerabilities to human security. First, shifting demographics, such as population growth, increasing urbanization and migration, and changing consumption patterns will result in increased demand for water resources. Second, a changing hydrological cycle due to human influences such as deforestation, land-use changes and the effects of climate change will have an impact on the water cycle and water availability. Third, increasing demands and competition for water resources across sectors, such as food, energy, industry and the environment, will put a strain on water resources. Finally, safe wastewater treatment and re-use will need to be managed so as to prevent pollution and contamination and protect the quality of precious water resources.

Multi-disciplinary approaches and cross-sectoral policies are needed to address water issues underlying human security. The cross-sectoral nature of water means it is critical to ensure that each sector's reasonable demands for water can be satisfied in a way that will also satisfy critical elements of human security. Integrated, cross-sectoral policies, coordinated decision-making and enforceable legal instruments and institutional mechanisms are needed to ensure that water acts as a linking factor to achieving security and that competition between sectors for limited water resources can be adequately managed (see for example Section 3A on Water Security and Human Rights, 3C on Exploring the Water-Energy-Food Security Nexus and 4A on Options for Responding to Water Security Challenges).

In recognition of its security implications on tensions and conflicts, UN-Water supports the inclusion of water security on the agenda of the UN Security Council. Climate change has been recognized by the UN Security Council for its security implications (United Nations Department of Public Information, 2011), with water being the medium through which climate change will have the most effects. Similarly, by including water security on its agenda, the UN Security Council will formally recognize the direct implications of water on human security issues: either as a trigger, a potential target, a contributing factor or as contextual information. Such recognition would acknowledge that water is in itself a security risk[4]; that acknowledging water insecurity could act as a preventative measure for regional conflicts and tensions; and that water security could contribute to achieving increased regional peace and security in the long term.

2B. Water Security and Transboundary Water Management

Transboundary waters pose enormous challenges for achieving water security. Where water systems, such as river or lake basins and aquifer systems, are shared across internal or external political boundaries, water-related challenges are compounded by the need to ensure coordi-

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[4] There is a long history of water-related conflicts, as documented in The Pacific Institute's Water Conflict Chronology (see: http://worldwater.org/conflict.html).

nation and dialogue between sovereign states, each with its own set of varied and sometimes competing interests (GWP, 2013). Around the world, there are some 276 major transboundary watersheds, crossing the territories of 145 countries and covering nearly half of the earth's land surface (MacQuarrie and Wolf, 2013). More than 300 transboundary aquifers have also been identified, most of which are located across two or more countries (Puri and Aureli, 2009).

Our freshwater resources

0.3% **Freshwater lakes & rivers**

30% **Groundwater**

70% **Ice and snow cover in mountainous regions**
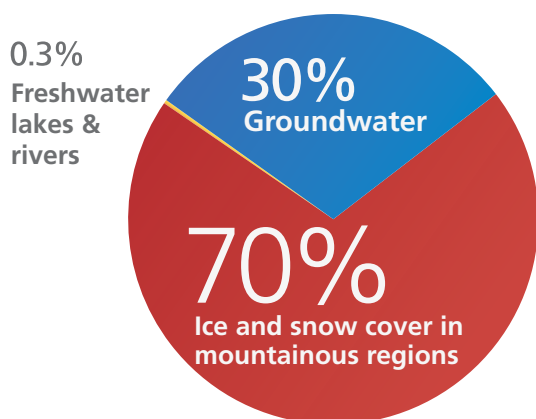
Source: World Water Assessment Programme (WWAP)

Transboundary water management and cooperation within and across states on the development and protection of transboundary water resources are essential in the context of water security. Transboundary water management (TWM) cuts across many sectors and disciplines, including international water law, water resources management and ecosystem protection, food and energy security, peace and political stability, human rights, international relations, and regional development and integration. Without ongoing dialogue and cooperation, unilateral development measures, such as hydropower development and water extractions, can lead to significant impacts on neighbouring countries sharing the same basin (Wolf, 2007). Such impacts can lead, for example, to river fragmentation, disrupting the health of aquatic ecosystems and adversely affecting communities downstream that may depend on fisheries for livelihoods and food security.

Achieving transboundary water security can stimulate regional cooperation, especially when supported by international instruments. While historically trans-

boundary water cooperation has been difficult, several examples from across the globe demonstrate that shared waters provide opportunities for cooperati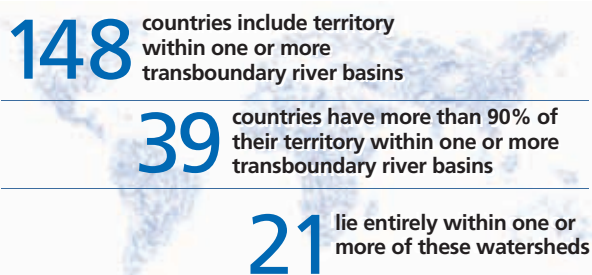on across nations and support political dialogue on broader issues such as economic integration and sustainable development. For example, the Southern African Development Community (SADC) coordinates transboundary water cooperation on 15 basins across Southern Africa. In Southeast Asia, the Mekong River Commission has decades of cooperation on river basin management among the lower Mekong countries. In Europe, degrading water quality and transboundary pollution prompted a move towards greater cooperation on the Danube River Basin (ICPDR, 2012). In Latin America, transboundary cooperation has taken place over hydro-electric development on the Paraná River between Brazil, Paraguay and Argentina. International watercourses, particularly when supported by international instruments such as the 1997 UN Watercourses Convention and the 1992 UNECE Convention, can help to alleviate increased incidents of water insecurity as a result of the pursuit of sovereign interests that may threaten regional peace and security.

Abundance of Transboundary Waters

148 **countries include territory within one or more transboundary river basins**

39 **countries have more than 90% of their territory within one or more transboundary river basins**

21 **lie entirely within one or more of these watersheds**

Source: UNESCO

The role of non-state actors is becoming increasingly important in the process of transboundary water cooperation. Non-state actors, such as community groups in border areas, individual and community rights holders, and water users, have largely been absent from the formal TWM process. The experience, knowledge and expertise of such actors can add legitimacy to decision-making, and provide valuable perspectives to the potential impacts on ecosystems and livelihoods. Their participation is essential to ensuring buy-in and effective implementation of joint development projects between states. Water governance systems are increasingly recognizing the need for trans-

boundary water management structures to engage these stakeholders, especially women as part of IWRM (Earle and Bazilli, 2013). Similarly, sub-national entities can have an important role in transboundary water management when supported by their governments, contributing to the establishment of trust among one another, leading to greater technical cooperation and paving the way for coordination and cooperation over shared waters once institutions are established.

The role of transboundary aquifers and management issues needs to be included in both national and international water legal systems. While aquifers contribute significantly to a global river basin's water availability, their collaborative governance across sectors and political borders has largely been overlooked, hampering efforts to achieve water security. Given the particular characteristics of transboundary aquifers and their greater vulnerability to contamination, exploitation, and the impending impacts from climate change, increased attention is needed to ensure that these resources are protected and sustainably and equitably managed (Cooley and Gleick, 2011).

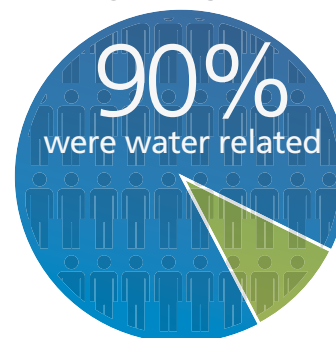## 2C. Water Security in Conflict and Disaster Zones

Water security is precarious in conflict or disaster zones, where it is subject to their negative impacts. Disasters and conflicts have an impact on water resources and related ecosystems by reducing their quality, quantity or both. In Sudan, violence broke out in March 2012 at the Jamam refugee camp, where large numbers of people faced serious water scarcity (McNeish, 2012). Disasters and conflicts reduce water security by compromising the physical infrastructure needed to access water, sanitation and hygiene services, such as treatment plants, drainage systems, dams, or irrigation channels. Conflicts and disasters may impinge directly or indirectly upon the social capital and human resources needed to run water-related infrastructure, along with the governance, social or political systems that keep water utilities functional and water services accessible (Donnelly *et al.,* 2012).

In conflict or disaster zones, inequitable and difficult access to water supply and sanitation services may

aggravate existing social fragility, tensions, violence and conflict, thus increasing the risk to water security. This is particularly true when water and related services are provided at the local level, where they are less resilient and more vulnerable to external shocks. At the local level either within countries or between border communities, water scarcity may lead to political instability or conflict, often exacerbated by attempts at profiteering through private uncontrolled sales of water. Threats to water resources or ecosystems can aggravate these conditions, fostering a vicious cycle that must be addressed when dealing with conflicts and natural disasters.

High percentage of water related disasters

Between 1991 and 2000 over 665,000 people died in 2,557 natural disasters of which

90% were water related

Source: WWDR, 2012

Conflicts and disasters can have cascading effects and far-reaching implications on water security, with political, social, economic and environmental consequences. Millions of people worldwide are forcibly displaced as a result of conflict and natural disasters, creating political tensions and social needs to support them; this was the case in 2012 when refugees from Mali were forcibly displaced to neighbouring Mauritania (Tana, 2012). Disasters and conflicts can destroy infrastructure and affect social, cultural and economic activities at the local level, also compromising wider political or environmental conditions, which can severely hinder a country's development (BCPR-UNDP, 2004). In 2011 alone, some 184,000 Somalis fled to neighbouring countries, with water and food insecurity linked to drought in the Horn

of Africa being among the major driving factors (UNHCR, 2011). Lack of infrastructure, such as roads and food storage, aggravated by poor regulatory and institutional governance, pose further problems. Conflicts and disasters can also affect water security by inhibiting access to water and water-related services, affecting health, social, cultural and economic activities of entire communities, as happened in South Sudan in 2012 (Ferrie, 2012).

Somali exodus linked to drought

In 2011 alone, some **184,000** Somalis fled to neighbouring countries, with water and food insecurity linked to drought in the Horn of Africa being one of the major driving factors
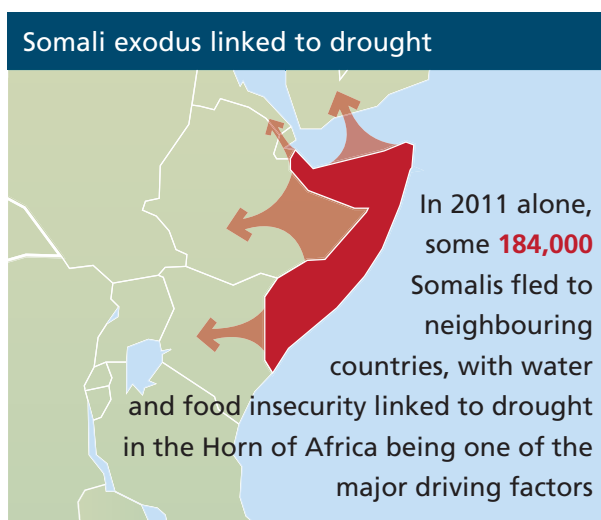
Source: UNHCR, 2011

2D. Progress and Success Stories in Achieving Water Security

Success stories from around the globe demonstrate how water security can be attained for people, nature and economic development; in turn, stories of failure to achieve water security offer equally important lessons for the future. When assessing either the success or failure around water security, it is important to consider for whom water security is being sought, for what purpose and at what level. Determining whether water security has been achieved also depends upon whether it comes for some at the expense of water insecurity for others: success stories on water security for a certain region or user might well spell disaster for downstream regions or users. Water security for all members of a transboundary setting present complex challenges but can also offer useful lessons where it has been achieved.

A step in the right direction: water security, underground water resources and transboundary water management in the Guaraní Aquifer, Latin America. The Guaraní Aquifer extends over an area of more than 1 million km^2 across Brazil, Paraguay, Uruguay and Argentina, with a population of 15 million living in the area overlying the aquifer. The area has abundant, but often polluted, surface water resources; there is thus a need to secure reliable water supply sources for drinking water while taking into account the expected increase in demand for water for high-value agricultural and industrial uses. At the national level, although each country sharing the aquifer has its own institutional framework for water resources management, until recently, no clearly defined mechanisms for transboundary groundwater management existed. In 2010, Argentina, Brazil, Paraguay, and Uruguay signed the Guaraní Agreement, which established the foundation for the aquifer's coordinated management in an effort to prevent conflicts over groundwater use, contributing to increased water security.

A turning point: the case of Lake Uromiyeh, Iran. In order to improve the living conditions of their people, stimulate economic activities and improve water security in the region, the provincial governments of West- and East Azerbaijan and the government of Iran have initiated many water development projects over the past 20 years, including the construction of dams and irrigation areas. However, increased withdrawals from inflowing rivers and a longer dry period have lowered water levels and raised salt concentration in the inland basin of Lake Uromiyeh. The Government of Iran has subsequently taken steps to protect Lake Uromiyeh against further degradation, with support from the UN. New legislation has been approved at the national level and a basin-wide organization has been established to manage and protect the lake. Agreements have been reached to stop further water-consuming developments in the basin and to reduce withdrawals during dry years. Establishing a good governance structure has provided a turning point for the lake's recovery.

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[5] This initiative was launched in 2010 between UNEP and the Nile Basin Initiative, and is currently in its concluding stages.

Cooperation over the Rhine River, Europe. The Rhine River is shared among nine countries and has an important economic value, particularly for the Netherlands and Germany, but also for other riparian countries, such as Switzerland and France. At the beginning of the cooperation process in 1831, through the adoption of the Convention of Mainz, water security was mainly defined in terms of navigation: the right for all to use the river and the duty of countries to provide infrastructure to make that possible. Over the years, cooperation on the Rhine has evolved to encompass a broader approach to international water management, including security issues such as the protection of fisheries, water quality, ecology and flooding. These efforts have resulted in a considerable improvement in the quality and ecological condition of the Rhine. At the same time, the riparian countries have developed effective operational systems to coordinate their actions during emergency situations such as disasters and extreme weather conditions (floods and droughts).

Making progress towards water security in the Nile Basin. The Nile Basin is the main source of water in the north-eastern region of Africa and is also one of the world's most politically sensitive and vulnerable basins. Water resources are under considerable stress due to a number of factors, including demographic, economic, social and climate changes, which in turn can exacerbate political tensions. The implementation of measures for achieving water security locally can have important impacts regionally, particularly for downstream users. For example, a project on adapting to climate change-induced water stress in the Nile River Basin[5] (UNEP, 2013) involving a variety of partners, including key representatives from riparian states and regional institutions, aims at addressing this situation to help strengthen future water security in the Nile Basin, with the additional benefit of encouraging dialogue and facilitating cooperation in a sensitive area important to all riparian countries. While collaboration can be challenging, it is the only option if long-term water security and stable development are to be achieved.

Section 3
Policy Relevance of Water Security

Water security consists of various dimensions, as detailed in the previous sections, which have interlinked impacts and consequences. Each of these dimensions has its own set of policy implications, which increasingly need to be coordinated if water security challenges are to be addressed holistically. This section explores the relevance of water security to policy formulation on a number of key dimensions – from human rights, to development, to the protection of ecosystems.

3A. Water Security and Human Rights

Recognition of the human right to safe drinking water and sanitation by the United Nations General Assembly and the UN Human Rights Council is an important step towards ensuring water security at the individual and community levels. Since the adoption of the UN resolutions on the human right to water and sanitation (United Nations General Assembly, 2010; United Nations General Assembly Human Rights Council, 2010b), an increasing number of states have explicitly integrated this right into national policy and/or legislation through new strategies, laws, and constitutional amendments (Boyd, 2012). This movement has fostered a new focus and emphasis on addressing the concerns of those who have traditionally been vulnerable, marginalized or left behind.

The UN resolution on the human right to water and sanitation acts as a catalyst for further policy discussion between stakeholders and across sectors, and in the development of programmes that make possible the full realization of the rights of individuals and communities. Progress toward realizing such fundamental human rights would strengthen the participation of all stakeholders, increasing their transparency and accountability. The integration of these human rights also emphasizes the role of water and sanitation in ensuring water security, two areas identified as major bottlenecks for the progressive realization of universal access.

A human rights-based approach to water security addresses critical gaps and bottlenecks, emphasizing the establishment of regulatory and enforcement

mechanisms for efficiency, participation, and account-ability. The formal recognition of a human right to water and sanitation will not in itself alter the realities on the ground, such as water scarcity, polluted wells and rivers, poor governance, a lack of investments in infrastructure, or the prevalence of inequalities. Nevertheless, it has already generated political will, providing a framework for development, conflict resolution, and accountability in the water services sector (see Box 2). By establishing clear legal obligations and reporting requirements for states resulting from the right to water and sanitation, the UN General Assembly (UNGA) Resolution and related declarations may lead to increased investments in these sectors, creating an environment that will facilitate the realization of other basic human rights that are critical to human dignity and the full enjoyment of life.

Water requirements for our basic needs

The UN suggests that each person needs **20-50 litres** of water a day to ensure their basic needs for drinking, cooking & cleaning

Source: World Water Assessment Programme (WWAP)

The momentum created by the UNGA resolution on the human right to water and sanitation can help bring the larger water security agenda to the atten-tion of the United Nations Security Council. Water security is dependent upon a sense of security at the individual level, which can be assured through recognition of the human right to water and sanitation. Recognition by the United Nations Security Council (UNSC) of water security issues would highlight the need for states to clarify obligations to prioritize human water use at the individual and community level as part of efforts to minimize tensions

Access to improved drinking water

One in 6 people worldwide - 783 million - don't have access to improved drinking water sources.

Source: World Health Organization (WHO) and United Nations Children Fund (UNICEF) Joint Monitoring Programme on Water Supply and Sanitation (JMP)

or conflicts. Given the inherent relationship of water to a wide range of cross-sectoral issues, recognition of water security by the UNSC would be seen as a renewed effort to address water issues within national and international policy. This is especially crucial in light of increasing water stress, scarcity, competition and water risks worldwide (see also Section 2A on Water and Human Security).

3B. Human and Economic Development through Water Security

Investment in water security is a long-term pay-off for human development and economic growth, with immediate visible short-term gains. Significant upfront investments may be required, but these will pay off in the long term through better institutions, increased capacity, improved levels of human well-being, environmental sustainability, economic production, and reduced conflicts. In the short term, water security can lead to increases in employment and education opportunities, especially for women and girls who often bear the brunt of responsi-bility for collecting water. In the long term, it results in reductions in health-care spending, productivity losses and labour diversions (UNDP, 2006). Investments in water security — including water services, capacity building, good governance, the maintenance of water-related ecosystem services, and natural infrastructure — mitigate the need for corrective measures and to some extent, the need for significant funds funnelled through channels such as development aid.

Box 2: Service Criteria for the Human Right to Water

(a) Sufficient quantity: Water must be available in a quantity sufficient to satisfy all personal and domestic needs.

(b) Water quality: Water must not pose a threat to human health.

(c) Regularity of supply: Water supply must be sufficiently reliable to allow for the collection of amounts sufficient to realize all personal and domestic needs over the day.

(d) Safety of sanitation facilities: Human, animal and insect contact with human excreta must be effectively prevented. Regular maintenance, cleaning and – depending on the technology – emptying is necessary to that extent. Sludge and sewage must be properly disposed of to avoid negative impacts on water quality and human health.

(e) Acceptability: Sanitation facilities, in particular, must be culturally acceptable. This will, for instance, often require privacy as well as separate male and female facilities.

(f) Accessibility of services: Services must be available within or in the immediate vicinity of each household as well as schools, workplaces, health-care settings and public places. Access must be ensured in a sustainable manner.

(g) Affordability of services: Regulation has to set standards regarding pricing. Water and sanitation services do not have to be provided for free and tariffs are necessary to ensure the sustainability of service provision. To meet human rights standards, the essential criterion is that tariffs and connection costs are designed in a way, including through social policies, that makes them affordable to all people, including those living in extreme poverty.

Source: United Nations General Assembly Human Rights Council, 2010a: Para 47, pp.16-17.

Prioritizing water security through access to water, sanitation and wastewater management leads to greater returns on social and economic growth and development, from the individual to the national level. The lack of availability and access to basic water and sanitation services impedes individuals and communities from achieving greater levels of well-being and benefitting from opportunities for social and economic development. This is particularly true for the most poor and vulnerable segments of the population, such as women and children. Investing in water and sanitation and wastewater management will lead to increased levels of human health, reduced levels of poverty and indigence, and increased opportunities for education and employment, resulting in overall national economic development.

Water security is embedded in development goals – as shown through the Millennium Development Goals (MDGs) – and lies at the heart of progress, and needs to continue to be included in the future

Sustainable Development Goals (SDGs). Despite its core link to development, the centrality of water to achieving the MDGs has been largely overlooked. Water security must therefore figure prominently in the post-2015 development framework, including through the setting of targets and indicators that reflect water's cross-cutting value to food, energy, and other priority

Decrease in education time

As it takes more time to gather water and fuel, the available time for education or other economic and political activities decreases.

Already, the majority of children worldwide who do not attend school are **girls**.
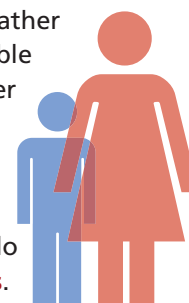
Source: UN Women

Figure 1. The Water-Food-Energy Nexus
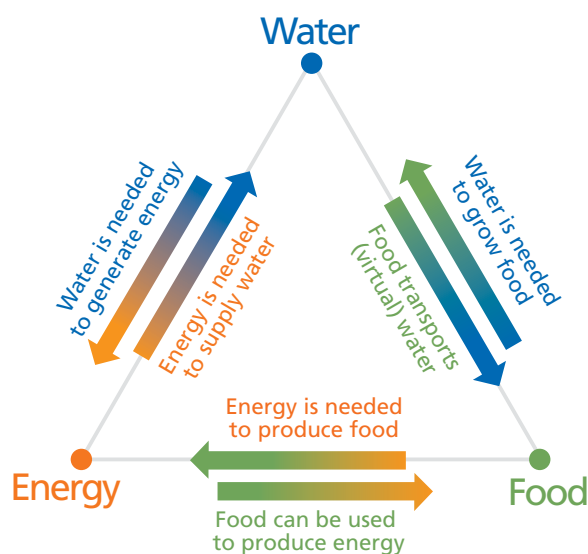
Adapted from: Water - A Global Innovation Outlook Report, IBM, 2009)

development areas. The SDG process must consider incorporating a goal and targets for achieving water security as a means of attaining economic and social development and environmental sustainability. Progress in many of the future post-2015 goals will be determined by how governments respond to the water crisis and whether they value water-related ecological services and incorporate these services into decision-making and development strategies (UNDP, 2006).

There needs to be increased investments in human development initiatives with a strong focus on water. Such initiatives should include development of capacities that encourage equity, empowerment, participatory and transparent decision- and policy-making processes, sustainability, productivity and accountability. The private sector offers one possible channel for increased funding and could be combined with traditional sources of financing from governments and donors. Investors are reluctant to invest in water-insecure areas, even though these places are the most in need of investment for development (Adeel, 2012; Grey and Sadoff, 2007). Making progress towards water security will therefore create new investment opportunities and improve the climate for local entrepreneurs.

3C. Exploring the Water-Food-Energy Security Nexus

Water, food and energy are inextricably linked security concerns and form a critical nexus for understanding and addressing development challenges. Water, energy and food are strategic resources sharing many comparable attributes: there are billions of people without access to them; there is rapidly growing global demand for each of them; each faces resource constraints; each depends upon healthy ecosystems; each is a global good with trade implications; each has different regional availability and variations in supply and demand; and each operates in heavily regulated markets (Bazilian et al., 2011). In this way, water, food and energy are fundamental to the functioning of society, closely interlinked (see Figure 1), and associated with deep security concerns.

Global Water Use
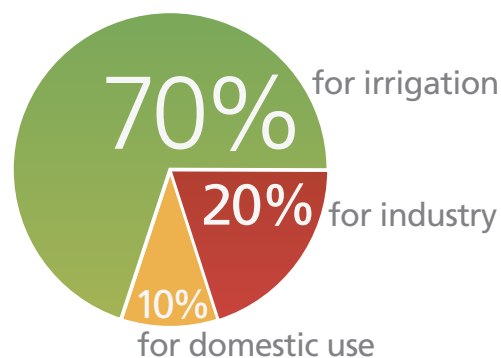
Source: World Water Assessment Programme (WWAP)

The nexus perspective focuses on the interdependence of water, energy and food, and recognizes their interconnectedness and the potential consequences of one sector on another. Institutional mechanisms within governments and other governance structures follow narrow mandates along sectoral lines, creating fundamental disconnects. This has often led to negative impacts, especially for the most vulnerable and marginalized, including hindrance of a transition towards a greener economy, acceleration of ecosystem degradation, depletion of natural resources, and slow progress towards development goals (Bonn2011 Nexus Conference, 2012). Addressing this security nexus in a holistic manner will

allow for greater efficiency based on systems thinking and prevent unintended negative externalities when implemented through policy integration and harmonization.

Daily water requirement

The daily drinking water requirement per person is **2-4** litres, but it takes **2,000 to 5,000** litres of water to produce one person's daily food.

drink per day

food per day
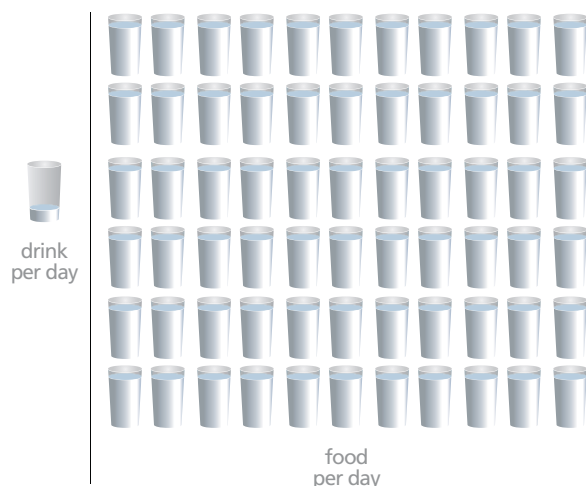
Source: Food and Agriculture Organization of the United Nations (FAO)

Adopting a holistic approach towards the water-energy-food security nexus can help reduce the potential for conflicts and tensions. The increasing interdependencies of water, food and energy may raise security concerns and create flashpoints for instability. The linkages between these three strategic resources make them central to achieving security, with their securitization increasingly being recognized in global dialogues (The Water, Energy & Food Security Nexus, Bonn 2011; Food Security in Dry Lands Conference, Qatar 2012; International Water Summit, Abu Dhabi 2013). By incorporating a holistic, nexus-driven approach that takes into account interdependencies across sectors and coordinated decision-making, the management of trade-offs and synergies can support a transition to sustainability (see also Section 4A on Responding to Water Security Challenges).

Developing economies pose a critical challenge in the water-food-energy security nexus affecting economic, social, and political stability as well as raising issues of equity. Emerging economies are characterized by common challenges such as population growth, increasing rates of urbanization, large investment needs in infrastructure development, the emergence of new consumers, and the impacts of climate change on freshwater availability. These challenges will place additional stress on water resources, with serious consequences for water, energy and food sectors in these countries, especially at the local level. The convergence of drivers on the water-food-energy nexus threatens water security, posing risks for public health, political stability, and continued economic growth in many developing regions of the world, with Asia being a notable example (see Box 3).

Re-orienting policy frameworks will help to address the challenges in the water-food-energy security nexus. First, governments need to strengthen public policies, including planning systems and appropriate pricing, gradually removing energy, agricultural and water subsidies, to ensure productive and efficient use of resources. Second, governments can work to reduce market failures by improving access to capital, enabling innovation, and supporting property rights for co-management of common pool resources. Third, governments can promote better supply and demand management by forging stronger links between water resources, the sectors that use or produce those resources, and global markets.

Box 3: Growing Demand for Water, Food and Energy in Asia

As population growth and urbanization rates in the region rise, stress on water resources in Asia is rapidly intensifying. For multiple reasons, already as many as 635 million people in Asia lack access to safe water, and 1.9 billion people lack access to effective sanitation (JMP, 2012). Strong income growth is also leading to changes in diets, favouring foods such as meat, which use more water inputs. Demand for energy is also expected to increase, particularly in China and India, where projections for water, energy and food in those countries suggest a sharp increase to keep up with demand and growth. Ensuring a secure supply of water, food and energy is essential given Asia Pacific's growing population, increasing demands, and increasingly scarce water and land resources.

Finally, governments must ensure increased consistency and coherence in decision- and policy-making processes.

3D. Climate Change and Water Security

Climate change impacts will have direct consequences for water security, which will vary according to geographic location. The Intergovernmental Panel on Climate Change (IPCC) points towards a great vulnerability of freshwater resources as a result of climate change, with severe consequences for economic, social and ecological systems (IPCC, 2008; IPCC, 2012). The effect on water security will differ regionally and will depend upon a number of factors, including geographic location and features, conditions of water availability and utilization, demographic changes, existing management and allocation systems, legal frameworks for water management, existing governance structures and institutions, and the resilience of ecosystems.

Rainfall to affect poverty figures

It is predicted that rainfall variability alone could push over **12 million people into absolute poverty,** while some predictions indicate that climate change could **increase global malnutrition by up to 25% by 2080.**
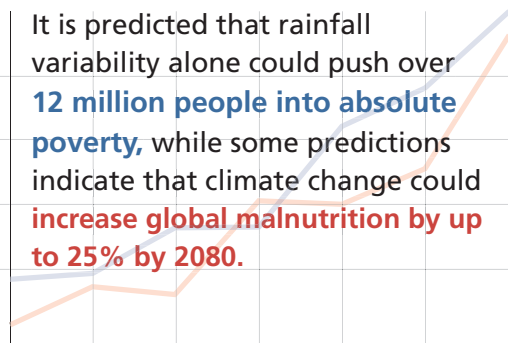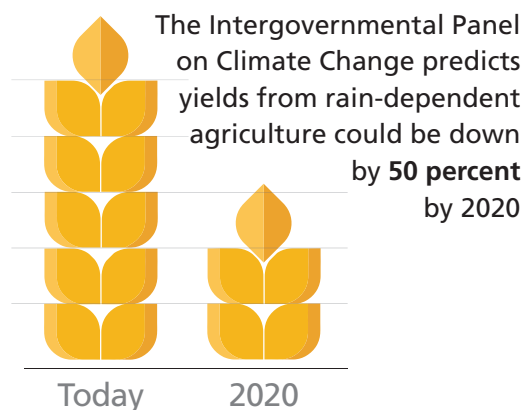
Source:United Nations Environment Programme (UNEP)

A majority of impacts from climate change will be on the water cycle, resulting in higher climatic and hydrological variability, with important consequences for societies and their water security. The IPCC (2012) expects an increased incidence of droughts due to decreasing trends in precipitation in some areas, while others will see an increasing incidence of floods and other extreme events such as cyclones due to increasing trends in precipitation intensity. Similarly, increased risk of water supplies or increased risk of sea-level rise will follow the melting of glaciers, while increased temperature and saltwater intrusion from rising sea levels will compromise water quality. Rainfall variability alone could push more than 12 million people into absolute

poverty (World Bank, 2006), while clima te change could increase global malnutrition by up to 25% by 2080 (Fischer *et al.*, 2002).

Daily water requirement

The Intergovernmental Panel on Climate Change predicts yields from rain-dependent agriculture could be down by **50 percent** by 2020

Today   2020

Source: United Nations Environment Programme (UNEP)

Changes in the hydrological cycle will threaten existing water infrastructure, making societies more vulnerable to extreme water-related events and resulting in increased insecurity. As witnessed by hurricane Sandy on the north-eastern coast of the United States in late 2012, extreme water events can increase water insecurity by affecting the functioning and operation of water infrastructure, including hazard protection, storage and delivery capacity, and pollution and wastewater management. Poor and marginalized communities can be even more affected, yet have much less capacity to adequately cope due to underlying factors such as environmental mismanagement, rapid and unplanned urbanization in hazardous areas, and failed governance (IPCC, 2012).

Ensuring water security in the face of climate change can be achieved through appropriate adaptation measures. Climate change impacts, combined with social, political and governance factors, will generate new or exacerbate existing water insecurities as availability, supply and demand of freshwater resources are increasingly affected (UN-Water, 2010). Adaptation options, innovative thinking, and more use of traditional knowledge are urgently needed in order to reduce water insecurity. UN-Water (2010) has made recommendations in this direction (see Box 4), addressing issues of governance and knowledge generation, among others.

Box 4: Recommendations from UN-Water on Improving
Water Security through Adaptation to Climate Change

a) Mainstream adaptation within the broader development context. Adaptation measures should be integrated into national development plans, establishing links with policies addressing food and energy security, poverty reduction, disaster risk reduction and environmental protection.

b) Strengthen governance and improve water and wastewater management. Participative, multi-stakeholder dialogue mechanisms should be established at various geographical scales (including transboundary), preferably within the context of IWRM frameworks. Mandates of relevant institutions need to be clarified and strengthened to ensure inter-sectoral planning and decision-making within legal frameworks and instruments.

c) Improve and share knowledge and information on climate and adaptation measures, and invest in data collection. The decline of hydrological networks needs to be stopped and reversed so that decision-making can be based on solid empirical evidence. Hydrological data need to be freely shared between stakeholders, and several gaps in knowledge need to be filled. International research needs to be strengthened in order to assess uncertainties such as those generated by climate change.

d) Build long-term resilience through stronger institutions, and invest in infrastructure and in well-functioning ecosystems. Managing risks and building capacity to deal with unpredictable events should be a priority, especially among the most vulnerable rural and urban poor. Systematic assessments of climate change resilience of all utilities, including rural water and sanitation programmes, are needed. 'No regrets' investment schemes are needed for both 'hard' adaptation measures such as infrastructure and 'soft' adaptation measures such as incentives and demand management.

e) Invest in cost-effective and adaptive water and wastewater management and technology transfer. The development and transfer of technologies, appropriately adapted to local conditions, must be facilitated, and the capacity to implement and operate them supported.

f) Leverage additional funds through both increased national budgetary allocations and innovative funding mechanisms for adaptation in water management. Improving adaptive capacity calls for more intelligent use of existing financing, targeted towards the most vulnerable groups and ecosystems. The full range of financing options needs to be used, including innovative financing mechanisms, private sources and public funding from developed countries.

Source: UN-Water, 2010.

3E. The Role of Ecosystems in Ensuring Water Security

Water security and ecosystems have a reciprocal relationship necessary for the enhancement of both. The relationship between water security and ecosystems is one of mutual benefit and support: ensuring that there is sufficient, good quality fresh water available to support the functioning of ecosystems will lead to ecosystems that are healthy and capable of providing the water needed for the benefit of human and natural communities. Such benefits include providing clean water, mitigating droughts

and floods, and supporting water availability in soils which underpins food security. Ecosystems no longer capable of providing water services will have a direct impact on providing key services for human, water and other securities.

Ensuring that ecosystems are protected and conserved is central to achieving water security – both for people and for nature. Ecosystems are vital to sustaining the quantity and quality of water available within a watershed, on which both nature and people rely. Nature alone cannot guarantee water security for people – it is based on contributions of nature and human ingenuity, where both

Box 5: Water Security, Fresh Water and Ecosystem Services

Freshwater resources, including rivers, lakes and wetlands, are degrading at the fastest rate compared to any other major biome (Secretariat of the Convention on Biological Diversity, 2010). This poses a key threat to water security and related ecosystem services.

Many water-related ecosystem services are clearly related to water security for humans, such as drinking water provision. Less obvious services are just as important: for example, sediment flows underpin land integrity, maintaining the resilience of coastal and delta regions to extreme weather events, such as storms and flooding.

The following four broad categories of services provided by fresh water and related natural systems express the close and mutually dependent relationship between ecosystems and water security:

a) Provisioning services or goods, which are often more visible and traded, including food, fibres and energy;

b) Regulating services, such as water purification, groundwater recharge and balancing, prevention of saltwater intrusion into coastal watersheds, flood control, and sediment transport and deposition;

c) Supporting services, which underpin other services, such as nutrient cycling, soil formation, primary production, habitat provision and biodiversity maintenance; and,

d) Cultural services, ranging from recreational opportunities to aesthetic and spiritual values.

Source: MA, 2003.

built and natural infrastructure are needed for efficient and effective management of water resources. Protecting water resources is essential for supporting the diverse domestic, agricultural, energy and industrial needs of humans, but also for supporting ecosystems from ridge to reef (GEF, 2004) and the key benefits they provide (see Box 5).

Sufficient fresh water, of both quantity and quality, is needed in order to ensure that ecosystems function properly, underpinning basic water security. Ecosystems, and the living things that depend upon them – including humans – are adapted to specific water conditions. Our current hydrological cycle has provided a period of relative stability on which we have come to rely (Sandford, 2012). Although ecosystems can cope with and adapt to variations in conditions, significant changes in water quantity, quality and timing will increase their stress and represent risks to their continued functioning and the life they support, thereby posing a risk to overall water security. Decision-makers must understand the value of functioning ecosystems and their benefits (see Box 6), so that they make choices that incorporate freshwater
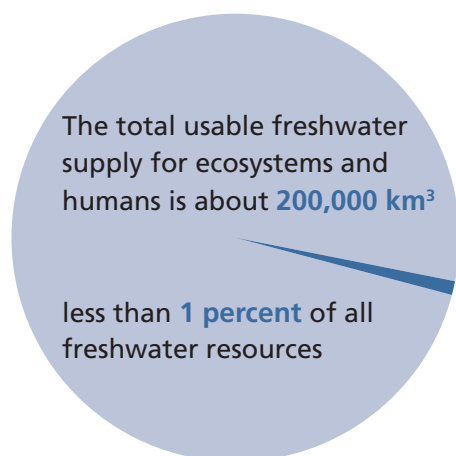
Our freshwater resources

The total volume of water on Earth is about 1.4 billion km³. The volume of freshwater resources is around **35 million km³**, or about **2.5 percent** of the total volume.

Source: United Nations Environment Programme (UNEP)

Freshwater availability is limited

The total usable freshwater supply for ecosystems and humans is about **200,000 km³**

less than **1 percent** of all freshwater resources

Source: United Nations Environment Programme (UNEP)

conservation considerations into decisions, from planning through to implementation and monitoring of projects.

Maintaining the integrity of ecosystems before they become compromised is an essential component of achieving water security and reducing the potential for conflicts. The continuous pace of human development is threatening the capacity of ecosystems to adapt, raising concerns that ecosystems will reach a tipping point after which they are no longer able to provide sustaining functions and services, and will become unable to recover their integrity and functions (Maas, 2012). Establishing sustainability boundaries will set the capacity of ecosystems before their limit is surpassed, acting as a preventative measure before crises and conflicts arise.

Box 6: Increasing Water Security through Natural Infrastructure

Solutions for water security that incorporate natural infrastructure can enhance efficiency, effectiveness and equity, but also spur implementation and progress towards long-term availability of water for all. Benefits include, among others:

Increase in drinking water supply: Watershed management saved US $5 billion in capital costs for New York City and US $300 million annually (Maître and Davis, 2001), and storage of Beijing's drinking water in Miyun watershed forests is worth US $1.9 billion annually (Wu et al., 2010).

Improved sanitation and wastewater management: The Nakivumbo swamp provides water purification for Kampala, Uganda worth US $2 million per year compared to costs of US $235,000 (Russi *et al.*, 2012).

Increased food security: Tonle Sap lake and Mekong river fisheries supply 70-75% of people's animal protein intake in Cambodia; they are worth up to US $500 million annually and employ 2 million people (MRC, 2005).

Reliable energy security: Investment in soil conservation has significantly extended the life expectancy of the Itaipu dam in Brazil and Paraguay (Kassam et al., 2012), and watershed management has been worth US $15-40 million for the Paute hydro-electric scheme in Ecuador (Emerton and Bos, 2004)

Drought management: Watershed restoration on the Loess Plateau, China has eliminated the need for drought-related emergency food aid to a region that is home to 50 million people (World Bank, 2013).

Climate change resilience: With investment in developing skills and water institutions, people in the Pangani river basin, Tanzania, are negotiating 'environmental flows' to sustain the ecosystem services they need for climate change adaptation, food and water security (Welling *et al.*, 2011).

Restored rivers: In the USA, 15 jobs are created for every US $1 million invested in river restoration (Kantor, 2012).

Section 4
Policy Response Options

The UN system is poised to play a key role in facilitating the achievement of water security through internal and external collaboration with stakeholders such as governments, water and research institutions, communities and individuals. This section highlights the key supporting elements needed to achieve water security – policies, capacities, governance mechanisms and structures – and options for addressing water security challenges.

4A. Responding to Water Security Challenges

Increasing water security will require tailored policy responses that can be adapted to local, national and regional contexts. While different scenarios can offer insights into how water systems might look in the future (see Box 7), proposed policy responses will build a foundation to strengthen and enhance the ability of water systems to withstand changes and the uncertainties of the future. Countries with flexible policy foundations and legal frameworks will enable them to adapt to a specific context

and changing circumstances in order to meet unique challenges and needs.

Achieving water security requires a holistic approach and a long-term perspective. Although progress has been made in some areas, serious challenges undermine human, social and economic development, such as absent or still unreliable water supply and sanitation services, wastewater collection and treatment, extreme weather events, and degraded ecosystems. These challenges call for a consideration of plausible future scenarios in order to create policy responses capable of coping with the increasingly complex context of our world (see Box 7).

Policies are needed on water planning, allocation and pricing, aimed at increasing water security through increased water efficiency in industrial, agricultural and domestic water use, while ensuring affordability for those who are unable to pay. Pricing water artificially lower than its actual cost, including as a result of subsidies, all too often leads to increased demand, waste and overuse across the domestic, agricultural and indus-

Box 7: Developing Scenarios under the World Water Assessment Programme

The World Water Assessment Programme (WWAP) has developed "Five Stylized Scenarios" (Gallopin, 2012) to explore how the world water systems might evolve between the next 20 and 40 years, considering a number of main driving forces that are setting and will continue to set future trends (e.g. demography, economy, technology, climate change, etc.). These scenarios set a useful analytical framework that conveys the urgency of achieving water security, especially in those countries that are already water-insecure.

In 2013, the "Water Futures and Solutions: World Water Scenarios" project, endorsed by UN-Water, entered its new 5-year phase, with plans to announce its interim findings in 2015 at the 7th World Water Forum. This new phase will focus on developing plausible scenarios and testing options to address the challenges for their sustainability.
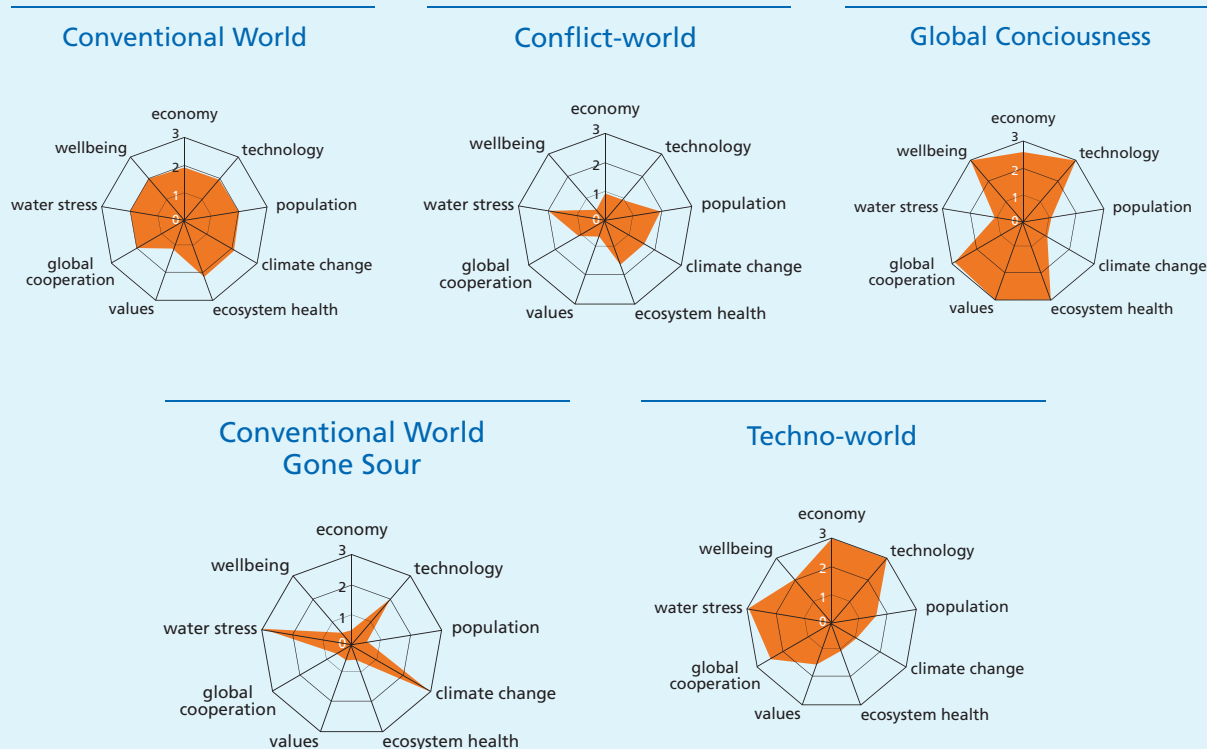
Figure: The Five Stylized Scenarios (Gallopin, 2012).

trial sectors. Establishing policies on water pricing that reflect its actual cost, including the cost of infrastructure, delivery of services and treatment, and the economic value of water itself, would encourage better use and conservation, thus enabling society to meet its increasing demands with limited available freshwater resources. Virtual water trade flows help to alleviate the burden of limited water resources in water-scarce countries; however, this needs to be set in the context of equitable international trade that considers comparative advantages amongst trading countries and ensures equitable flow of benefits.

Creation of an enabling environment and supporting policies for the use of unconventional water sources, such as wastewater management, for the redeployment, recovery and reuse of water for human and other competing uses, is needed. There is enormous potential for wastewater to contribute to achieving water security, particularly in areas with acute levels of freshwater scarcity and increasing problems of water quality deterioration. Wastewater treatment and reuse, supported by relevant research and pertinent policy-level interventions, can transform this untapped resource from an environ-

Global water scarcity

- High water scarcity
- Moderate water scarcity
- Low water scarcity
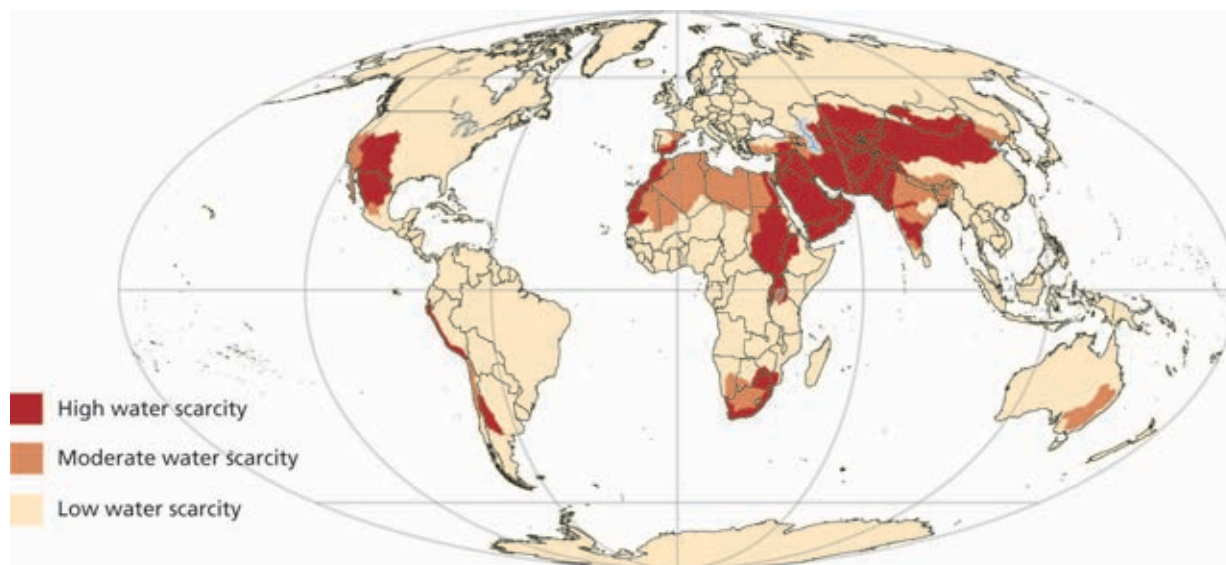
Source: Food and Agriculture Organization of the United Nations (FAO)

mental burden and health constraint into an economic asset that contributes to achieving water security while maintaining the health of people and the environment. Appropriate policies can guide the use of non-conventional water sources, including sufficient financial commitment for policy implementation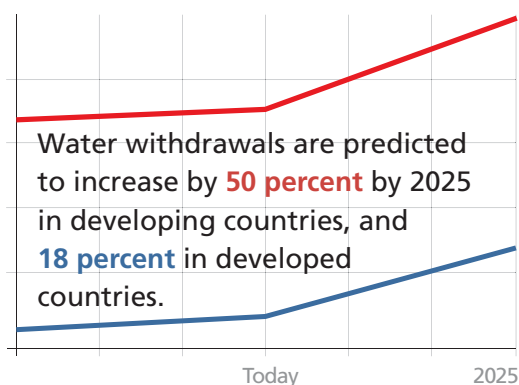 and education of stakeholders, supported by increased collaboration between researchers, international organizations, governments, and water users (Qadir et al., 2006). Such policies could include water planning, setting appropriate standards for water re-use, market-based reallocation, watershed management, and payment for ecosystem services.

Water withdrawals

Water withdrawals are predicted to increase by **50 percent** by 2025 in developing countries, and **18 percent** in developed countries.

Today 2025

Source: Global Environment Outlook: environment for development (GEO-4)

Innovative financial mechanisms can contribute to the goal of achieving water security through a supportive policy environment. Traditionally, the majority of financing for initiatives that help to achieve water security has come from the public sector (Adeel, 2012). New and innovative sources of financing require a policy arena conducive to ensuring that investments are protected and can provide secure options for long-term financing. Options include investments from the private sector, micro-financing schemes, and innovations such as crowdsourcing.

4B. Capacity Development to Ensure Water Security

The lack of capacity related to water – human, financial, institutional, technological, and service-provisioning – is a major hurdle towards achieving water security. As water security has social, humanitarian, economic, legal and environmental dimensions, it requires an equally wide range of capacities and expertise that go beyond the immediate management of available water resources. In particular, capacity development at the institutional level is of great importance, as it sets the framework for capitalizing on human capacities and coordinating multi-sectoral policies. In many countries, such institutional frameworks, particularly those which allow

for trans-sectoral decision- and policy-making, are often poorly developed.

Water security will require a wide range of capacities, using a multi-disciplinary approach to adequately address a similarly wide range of demands. Water resources are needed to satisfy a wide range of demands, from drinking water supply to agriculture and energy production, to water for ecosystems. Increased demand affects trade, commerce and economic growth and development, calling for increased skills and capacity to assess and monitor resources, understand the impacts of global change to better inform on suitable adaptation strategies, prepare for disasters, increase cooperation between countries that share transboundary resources, integrate the value of ecosystem services into policy, and support ongoing cross-sectoral dialogue and mutual learning among those making decisions.

Capacity development is needed at different levels and requires a cross-sectoral enabling environment that supports water security. Capacity will be needed at various levels, from individual to organizational and institutional, in order to reduce vulnerability to water insecurity, with poor capacity at various levels and across disciplines often cited as a major hurdle to the attainment of water security (UNW-DPC, UNESCO-IHP and BMU, 2009; UNEP, 2012). Supporting policies, laws and infrastructures will create the right enabling environment to allow for increased capacity based on environmental potentials and limits and country- or region-specific needs (UNEP, 1993). Such policies need to reach across disciplinary and institutional boundaries so that water resources management can take place in an integrated and sustainable way.

Policy-makers need to identify existing capacities, as well as gaps, in order to properly address the water security challenge. Such assessments need to be undertaken at both the institutional and relevant geographical (national, river basin, etc.) levels. At the individual level, an assessment of human capacities for water services and climate change freshwater adaptation is needed (WMO and UNESCO, 1997); at the institutional level, an assessment of performance and capacity to respond to changing circumstances is essential (WWAP, 2012). In many regions,

increasing water-related capacities depends on increasing the number of adequately educated and trained water professionals, or developing the institutions required for adequate water management to support water security.

Increased capacity for water security depends on data availability on the quantity and quality of water resources, as well as financing for implementation of interventions. Sound management of water resources relies as much upon the knowledge of available water resources and their dynamics as well as on their uses and users. Such management can only be achieved with data of sufficient quality, which requires adequate human and financial resources. Better quality data and monitoring and reporting of water resources will lead to an increase in knowledge, which will support the ability to make informed decisions for enhancing water security through better water resources management.

Capacity development is a long-term process based on incentives, good governance, leadership, and knowledge management and transfer, which needs to be continuously adapted according to stakeholders' feedback and needs. Capacity development is an organic learning process based on agreed norms, respect for value systems and fostering of self-esteem. For capacity development to be successful, it needs to integrate external inputs into national priorities, processes and systems, build upon existing capacities rather than create new ones, remain engaged under difficult circumstances, and, above all, remain accountable to the ultimate beneficiaries (OECD, 2006). Capacity development requires accountability through the monitoring of outcomes and impacts from the perspective of its beneficiaries.

The UN-system, and in particular UN-Water, can address gaps in capacity by emphasizing collaboration amongst agencies, fostering trans-sectoral coordination at the national level, providing education and training to support institutional capacity development, and establishing a knowledge community to address water security challenges. Capacity development leading to improved water security requires applying trans-disciplinary, multi-level, multi-stakeholder, and gender-sensitive approaches. Through UN-Water, such

Box 8: A List of Key Issues Critical for Establishing Good Water Governance

The following issues constitute useful benchmarks to gauge how well a country's water legislation and institutions respond to evolving socio-economic and environmental conditions, and what kind of reform will help to achieve related water security goals.

1) Establishing the river basin and/or the aquifer system, as appropriate, as the basic bio-geographic unit for water management, requiring coordination and cooperation between political units across national and international borders;

2) In areas where important groundwater aquifers do not coincide with river basins, special attention should be given to the coordination and cooperation over these aquifers, particularly in establishing mechanisms and incentives that move away from unsustainable groundwater pumping to the sustainable management of groundwater resources;

3) Reconciling the security of water rights with risk, uncertainty of resource availability and supply, and sustainability through measures such as the periodical review of permits, avoidance of monopolization, and transfer of negative externalities;

4) Pursuing efficiency gains and providing for dispute resolution mechanisms, in order to offer equity and flexibility in the allocation of water rights among competing uses;

5) Prioritizing the environment and vital human rights in water allocation policies, laws and decision-making processes, including requirements to assess and manage environmental flows;

6) Integrating water resources management of surface and underground waters with land and biological resources governance;

7) Empowering water users and other stakeholders to take on greater responsibility, access relevant information and administrative and judicial remedies, and participate in decision-making processes regarding water management and allocation;

8) Accounting for customary water allocation systems, rights and practices at the local level, where these exist;

9) Strengthening risk management of water-related natural hazards, including the use of early warning systems;

10) Protecting freshwater ecosystems of high conservation value from infrastructure development, including the designation and management of protected areas.

Source: Burchi, 2012.

approaches can be achieved through the integration of new partners, associates, sub-regional and country networks, catalysers, brokers, donors, capacity development and demand centres, which can scale up capacity at all relevant levels. Other factors include capacity-building courses, educational materials based on experiences and lessons learned from all regions, and technical advisory assistance to identify relevant expertise.

4C. Improved Water Governance and Water Security

Good governance is a prerequisite to achieving water security, as the international community has long and repeatedly recognized. Poor governance mechanisms, expressed through weak legislative and institutional arrangements, underinvestment, poorly enforced legislation and accountability mechanisms, and corruption,

hamper efforts to achieve water security (International Freshwater Conference, Bonn 2001; World Water Forum, Istanbul 2009; World Water Forum, Marseille 2012). Governance mechanisms necessary for water security include operating capacity, transparency, participation, accountability, and access to legal recourse. Such objectives are best achieved through formal agreements and processes at the national and international levels.

Good water governance relies on well-designed, empowered institutions to enact and enforce legislative and policy instruments and are conducive to the attainment of predetermined social, economic and environmental goals associated with water security. Governance may be expressed through different organizational structures and arranged according to local conditions, capacities and agreed domestic and international policy goals. Governance structures must take into account power groups and local arrangements when designing systems aimed at improving water security in an efficient and sustainable manner. For example, a review of national water governance systems shows a variety of water allocation mechanisms, such as those that grant permits by competent authorities, those which are market-based, or a combination of both (Le Quesne *et al.*, 2007).

Water governance is an evolving process that requires continuous refinement as it responds to new challenges, information, experiences, and problems. Achieving water security requires institutional and regula-

tory support, capacity for change, adaptive management structures, new forms of relationships, and multi-layered models capable of integrating complex natural and social dimensions (see Box 8). A number of international instruments have been under development for the last two decades (see Box 9). In response to emerging threats and trends, such as climate change and rapid economic and population growth, different regions are already modernizing and reforming water legislation and water management systems. For example, among Latin American and Caribbean countries, there has been a growing modernization of the sector's legal frameworks, which, in many cases, were non-existent or obsolete (Hantke-Domas, 2011).

Financing is essential for good water governance, with the private sector poised to play a key role in this regard. Global business has already put water on its agenda in recognition of the importance of reliable water supplies and healthy living conditions and the associated need to manage business risks. As a next step, corporate water stewardship should adopt a more consistent and transparent approach to the development and enforcement of modern legislation. Such recognition has already begun through the establishment of the UN Global Compact (United Nations Global Compact, 2012), which prioritizes good governance together with corporate development and growth. Cooperation of the private sector with water authorities on capacity-building, data generation, and technology transfer will further support increased capacity in governance.

Box 9: Existing Global Legal Frameworks for Transboundary Water Management

A number of countries have been working to ratify existing framework water conventions and implement related guidelines and best practices; some examples of relevant instruments include the following:

- The 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses, which today counts 30 contracting states – only 5 short of the number required for entry into force;

- The 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, expected to be open for accession by all UN member states by late 2013 or early 2014; in the meantime, countries can benefit from the wealth of knowledge and tools developed to facilitate its implementation; and,

- The 2008 ILC Draft Articles on the Law of Transboundary Aquifers, which should be considered in terms of how they can be best applied to specific aquifers.

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List of Acronyms

AIDA	Association for International Development Agencies
BEFS	Bioenergy and Food Security Project
FAO	Food and Agriculture
GEF	Global Environment Facility
GWP	Global Water Partnership
IAH	International Association of Hydrogeologists
ICID	International Commission on Irrigation & Drainage
ICPDR	International Commission for the Protection of the Danube River
IPCC	International Panel on Climate Change
IUCN	International Union for Conservation of Nature
JMP	Joint Monitoring Programme
MDG	Millennium Development Goals
NBI	Nile Basin Initiative
SDG	Sustainable Development Goals
SIWI	Stockholm International Water Institute
TWM	Transboundary Water Management
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNGA	United Nations Generaly Assembly
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNSC	United Nations Security Council
UNU	United Nations University
UNU-EHS	United Nations University – Institute for Environment and Human Security
UNU-INWEH	United Nations University – Institute for Water, Environment and Health
UNW-DPC	UN-Water Decade Programme on Capacity Development
USAID	United States Agency for International Development
WMO	World Meteorological Organization
WWAP	World Water Assessment Programme
WWF	World Wildlife Fund

UN-Water produces a number of documents for a variety of purposes. The purpose of the Analytical Water Brief is to serve as a basis for discussions related to UN-Water's areas of focus through its Work Programmes, Thematic Priority Areas, and Task Forces.

The Analytical Brief is used to identify potential activities for UN-Water and can be used as a tool for substantive discussions with various key stakeholders. The Analytical Brief is published in time for relevant major events and will support UN-Water to engage in discussions on emerging issues.