

The United Nations and Water

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**The United Nations
and Water**

INGENIERÍA Y TERRITORIO · 91

- 2** Editorial
- 4** Part one: The United Nations and water. Introduction
Josefina Maestu Unturbe
- 6** UN-Water: United Nation's response to the global water crisis
Zafar Adeel
- 10** The Millennium Development Goals from the perspective of water
Nikhil Chandavarkar y Helena Caballero
- 18** Financing sanitation and water in Latin America and the Caribbean.
Getting off-track countries on track to meeting the MDG target
Sue Cavill, Federico Properzi y Peregrine Swann
- 28** Best practices in transboundary water management
Olcay Ünver, Léna Salamé y Thomas Etitia
- 36** UN-Water Thematic Priority Area on Water and Climate Change:
Background, goals and achievements
Claudio Caponi
- 48** Part two: Civic organisations and associations and water. Introduction
Tomás A. Sancho Marco
- 50** The world's water operators
Ángel Simón Grimaldos y Fernando Rayón Martín
- 58** World water disputes: towards an international solution
Eliseo Bayo
- 64** Engineering, the essential response to the challenge of water for all
and sustainable development
Emilio Colón y Tomás A. Sancho Marco
- 74** The Spanish experience in water planning and management
by water basins
Francisco Cabezas Calvo-Rubio
- 80** Water in Latin America
Miguel Ángel Ródenas Cañada
- 90** The Cooperation Fund for Water and Sanitation
and its contribution to achieving the MDG
Adriano García-Loygorri Verástegui y Enrique J. Sánchez Elvira



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EDITORIAL

We are children of water and, as such, spend our lives wishing to return to it, like the maternal womb.

Water is life. But we could also say that human life is water. Without water, we do not exist; without water, we would never have been.

No wonder, then, that we rediscover in the following pages that humanity needs water, primarily, to survive, but also to become that wonderful amalgam of desire for love and knowledge that we are when we are good, rather than that of a childish desire for dominance and ignorance (disguised as immanence) that we are when we are bad. Humanity, unlike Mae West («When I'm bad, I'm better»), is better when it is good.

And for this, both clean drinking water and basic sanitation services need to be available to the population.

Achieving this goal, so simply expressed, would mean the transformation of despair into opportunity for hundreds of millions of people. This special edition of *Ingeniería y Territorio* ("Engineering and Territory"), conceived and created ex aequo with UN-Water from its office in Zaragoza, seeks to contribute to this goal. We should thank many people, starting with the authors, whose generosity has brought forth the content, however, in the interests of brevity, we will limit ourselves to thanking the coordinators, Josefina Maestu, from the United Nations, and Tomás Sancho from *Ingeniería y Territorio*. This issue's creation is thanks to their determination, will and intelligence.

I hope that all of you, dear readers, have the same experience as me, and that reading these articles fills you with awareness of how fortunate we are and how much civil engineering can do to for the betterment of humanity.



Water for the body, happiness for the eyes, and hope in the heart. (© Photo: Rafael Vargas).



Part one: The United Nations and water

Introduction

Josefina Maestu Unturbe

UN-Water, as a coordination mechanism, promotes the goals of the Water for Life Decade. The United Nations must promote the *efforts of all the different stakeholders* in order to meet international commitments and *keep global attention and political impetus positively focussed, at all levels, on the water and sanitation agenda*. The United Nations Decade Programme on Advocacy and Communication helps raise consciousness of the work carried out by the United Nations on water matters, and not only works with experts and governments, but also with the citizens themselves, particularly *the most poor*.

The Programme plays a fundamental role: promoting more responsible international governability, increasing transparency in the work of UN-Water members and partners, and improving the local impact of United Nations agencies. However, most important of all is the goal of *providing citizens with a forum to make themselves heard on water matters within the United Nations system*, which in many instances it is the only means citizens have.

Transparency, access to information, agent involvement and public participation are all important elements in the United Nations' Agenda 21. The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (the Aarhus Convention) is based on principle 10 of the Rio Declaration. Principle 10 of Agenda 21 states that best practice for dealing with environmental matters is to ensure the participation of all the stakeholders, including women, young people, indigenous groups and local communities. Governments, the United Nations and other associated organisations can carry out activities to *raise public awareness such as: education programmes* to help groups of users optimise water management, citizen-participation

methods in decision-making bodies, and, especially, strengthening the role of women in the planning and management of water resources. Other activities include *spreading information* through operating and educational manuals for users or by celebrating World Water Day.

This issue of *Ingeniería y Territorio* ("Engineering and Territory") expresses this aspiration.

The article by current UN-Water president, Zafar Adeel, shows how reaching the water-related goals will need all developing countries to have sufficient and suitable resources to fight against the negative trends associated with the world water crisis. The constitution of UN-Water in 2003 by several United Nations organisations and agencies is a clear acknowledgement of this. It is a mechanism which tightens coordination and coherence between United Nations entities in their dealings with all water and sanitation matters which include: surface and underground water, the link between drinking water and sea water and water-related natural disasters.

Doctor Adeel explains how UN-Water acts as a coordination mechanism for the 28 United Nations organisations with water programmes. UN-Water is also made up of many international associations (presently 24) who represent civil society and several non-governmental organisations. The presidency and vice-presidency rotate between UN-Water agencies every two years and the permanent secretary, managed by the United Nations Department of Economic and Social Affairs (UNDESA) in New York, provides administrative, technical and logistical support.

In Nikhil Chandavarkar's article, the permanent secretary of UN-Water and Helena Caballero assesses, at the midpoint of the Decade and two thirds through the period established for achieving the Millennium Development Goals (MDGs), progress made on the agreed commit-

ments, considering each Goal's set targets, and pointing out remaining difficulties for achieving the Goals, highlighting along the way how water plays a part in each one. Proven, effective measures are also presented along with structural changes that are needed to achieve the Goals.

The authors Sue Cavill, Federico Properzi and Peregrine Swann, from the World Health Organisation, show in their article how to reach the water and sanitation management targets set out in the seventh Millennium Development Goal. Not only would their approach reduce sanitation costs, but it would also improve school attendance, promote gender equality and drive productivity and economic growth. Even so, latest figures suggest that 2.6 billion people are still living without basic sanitation services. Testimonials show that, in spite of the fundamental role played by sanitation and clean drinking water in reducing poverty and achieving the MDGs, they are not priority items on the international agenda nor the agendas of many countries. The authors compile the main conclusions from 2010's GLAAS report and show that one of the largest impediments to improving access to water and sanitation is the countries themselves and that financial organisations still do not allocate adequate attention or resources to improving water systems and services.

Olçay Ünver, coordinator of UNESCO's World Water Assessment Programme, and authors Léna Salamé and Thomas Etitia explain that water is a basic requisite for life, a prerequisite for development, and also guarantees a long list of human rights. The challenge of achieving water security through cooperation and peaceful management of transnational resources is revealed to be even more important given there are 3 billion people living in countries through which 276 transnational rivers flow and that cover almost 45% of the planet's surface. Growing demand also exerts a strong pressure on the resources of the approximately 274 aquifers which cross international boundaries. In his article, Olçay Ünver provides examples of best cooperation practices for various areas and situations, along with lessons learnt from cooperative management of the water basins of the Columbia, Nile and Mekong rivers. He underlines the role that the United Nations has to play in creating peaceful cooperation and driving political goodwill. He also provides examples from water programmes such as the World Water Assessment Programme (WWAP) and the "From Potential Conflict to Cooperation Potential" (PCCP) programme.

Claudio Caponi, coordinator of the UN Task Force on Water and Climate Change, explains how water is the unifying link between climate, society and ecosystems. The effects of climate change on the economy, human health, hunger and disease frequently affect people's way of life through water resources, impacting as much the availabil-

ity (quality and quantity) of drinking water as the frequency of floods, droughts and seasonal changes. The fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) warned that thousands of millions of people would suffer water shortages as a result of climate change, particularly those in developing countries.

All these issues discussed by the authors have been the object of discussion in 2010 – a year which presents new challenges for water and sanitation. 2010 is the year the Midterm Progress Review of the Decade for Water and Sanitation took place in Tajikistan, and in September the General Assembly reviewed the completion of the MDGs. The review examined progress made through the implementation of water programmes and projects during the first five years of the International Decade for Action "Water for Life" 2005-2015. The review highlights that there are ongoing problems and new issues resulting from world crises, particularly the crises of energy, food and finance. There are major obstacles, added to which are the increasingly apparent effects of climate change. It was highlighted that national governments are responsible for defining suitable policies and allocating sufficient budget to the water resource sector since water is crucial to achieving the MDGs. Developing countries should receive sustained and reliable financial aid and fair and equitable transfers of technology, according to the principle of co-responsibility, in order to overcome the challenges of clean drinking water, sanitation and the application of adaptive climate-change strategies at a national level.

The review process concludes that continual reinforcement of national governments' political goodwill, financial commitments and development aid is required. This should be the maximum priority in order to achieve the water-related, internationally-convened goals before the end of the Decade for Action "Water for Life" 2005-2015, especially in developing countries. Countries must assign due priority to questions of water and sanitation at the next High-level Plenary Meeting of the sixty-fifth session of the United Nations General Assembly when the Tajikistan government presents the findings of the mid-term Water Decade review.

With 2.5 billion people lacking access to basic sanitation and almost 900 million without access to safe drinking water, there is still much work to be done. Water and sanitation are crucial for sustainable development and indispensable for human health, dignity and wellbeing: Water is essential for life. □

Josefina Maestu Unturbe
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UN-Water: United Nation's response to the global water crisis

Zafar Adeel

KEYWORDS

WATER
UNITED NATIONS COORDINATION
DEVELOPMENT
SANITATION
WATER DISASTERS
GLOBAL POLICY

UN-Water, the context

The context of UN-Water is defined through a multi-dimensional global water crisis. Most significantly, the crisis impacts developing countries in which there are close to a billion people without access to safe drinking water and 2.6 billion people without access to adequate sanitation. The direct impacts of this lack of access are severe on societies in developing countries: over 3.5 million people die each year due to preventable water-related diseases, and nearly half of them are children under the age of 5. The indirect impacts relate to costs on public health and educational systems as well as overall productivity of work forces. Time lost in fetching water and through sick days prevents people from investing their time effectively in generating livelihoods or rising above poverty.

There are two coupled challenges: First, which pertains to unsustainable use of water resources for a variety of societal uses to fulfil domestic needs, agricultural production, mining, industrial production, power generation, and forestry practices. According to the Millennium Ecosystem Assessment, over 2 billion people live in water-scarce environments; a trend that is projected to exacerbate as a result of global climate change. Second, human societies are often responsible for degrading the quality of their water resources. For example, every day about 2 million tons of sewage, industrial and agricultural wastes is poured into the world's waters. This despite our knowledge that water bodies cannot be considered infinite sinks for our waste.

Addressing the global water crisis requires availability of water of adequate quality and in sufficient, sustainable volumes. A coherent, coordinated approach is clearly required as these issues represent some of the most urgent development challenges of our time. We must manage freshwater sustainably so that everyone has enough water to drink and stay clean and healthy; food producers have enough water to satisfy the demands of growing populations; industries have enough water to meet their needs; and countries have opportunities to secure a reliable supply of energy.

Achieving these multiple goals requires that developing countries should possess sufficient and adequate resources to reverse the adverse trends associated with the global water crisis. The UN system duly recognizes this fundamental need to overcome the capacity deficits in developing countries and has collectively responded. The creation of the UN-Water in 2003 by the heads of United Nations organizations and agencies – as a group that now comprises 28 UN and 24 international partner organizations – is one clear manifestation of this recognition. It is a mechanism that strengthens coordination and coherence among UN entities dealing with issues related to all aspects of freshwater and sanitation; this *inter alia* includes surface and groundwater resources, the interface between freshwater and seawater, and water-related disasters.

How the UN-Water operates

The UN-Water operates as a coordination mechanism whose real strength lies in the actions of its members; the number of member United Nations organizations stands at 28. Senior programme managers from UN-Water member agencies meet twice a year. An elected chair and a vice chair, which rotate among UN agencies every two years, represent the UN-Water at international conferences, major fora and processes and oversee the implementation of the UN-Water work programme. A permanent Secretariat, hosted by the United Nations Department for Economic and Social Affairs (UNDESA) in New York, provides administrative, technical and logistical support. The UN-Water also comprises numerous partners (24 at present) which represent civil society and various non-governmental organizations.

While the coordination function of UN-Water is supported through internal resources provided by the UN-Water members, activities are supported through donor trust funds. The members and partners who take part in various activities implemented primarily through time-bound task forces and the UN-Water programmes that represent the primary “capital” of UN-Water.

As a key element of its work UN-Water comprises four global programmes:

The World Water Assessment Programme (WWAP)

WWAP synthesizes data and information gathered from UN-Water members and other prominent stakeholders, including non-governmental organizations, universities, research centers and countries. It presents its findings through the triennial World Water Development Reports. The Programme examines the nature of water crises around the world and reviews countries’ ability to address them. It aims to enhance assessment capacity at a national level; informs the decision-making process by indicating how well water policies and management strategies are working; and suggests indicators that are needed to monitor progress. WWAP is hosted by the United Nations Educational Scientific and Cultural Organization (UNESCO). It is located in Perugia, Italy with significant support from the Italian Government.

The WHO / UNICEF Joint Monitoring Programme on Water Supply and Sanitation (JMP)

The JMP, which operates under the aegis of the UN-Water, is an autonomous programme implemented and supervised by WHO and UNICEF. Established in 1990, the JMP continues monitoring activities that WHO has been undertaking since the 1960s. It is the official mechanism of the UN System mandated to monitor global



Fig. 1. UN-Water booth at the Stockholm World Water Week 2010.

progress towards the MDG targets for drinking-water and sanitation. The JMP’s biennial global reports on water and sanitation coverage facilitate planning and management by supporting countries’ monitoring efforts.

UN-Water Decade Programme on Capacity Development (UNW-DPC)

Through the mapping of the UN-Water capacity development activities, the assessment of capacity needs and gaps analysis, and through the development and support for the implementation of innovative capacity development methodologies, UNW-DPC strengthens UN-Water’s capacity development activities. Launched in 2007, UNW-DPC is hosted by the United Nations University (UNU) at the UN Campus in Bonn, Germany, with support from the German Government.

The UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC)

Using information and outputs generated by the UN-Water members and partners, UNW-DPAC develops communication campaigns illustrating the benefits of sound water management for poverty reduction and advocates for actions to implement effective water policies. Launched in October 2007, UNW-DPAC is implemented by the United Nations Office to support the International Decade for Action Water for Life 2005-2015. It is based in Zaragoza, Spain and hosted by UNDESA; the programme is supported by the Government of Spain.

Reports generated by UN

One of UN-Water’s key responsibilities is to monitor and report on the progress being made toward reaching internationally agreed upon water and sanitation targets, with particular focus on the targets set by the MDGs and the 2002 World Summit on Sustainable Development.



Fig. 2. Water distribution by UNAMID in Tora, Northern Darfur, Sudan. 2009. Source: UN Photo / Olivier Chassot.

World Water Development Report (WWDR)

The triennial World Water Development Report (WWDR), a comprehensive review of the state of the world's freshwater resources, is the United Nations System flagship report on water. The Reports provide a mechanism for monitoring changes in freshwater resources and their management. Coordinated by the WWAP, the development of the WWDR is a joint effort of the entities that make up UN-Water and is carried out in collaboration with governments, international organizations, non-governmental organizations and other stakeholders.

WHO/UNICEF Joint Monitoring Programme on Water Supply and Sanitation

The JMP reports assess the progress being made toward reaching the MDG water and sanitation targets. JMP produces drinking-water and sanitation coverage reports biennially, as well as reports on specific aspects of drinking-water and sanitation. The reports utilize data principally from nationally-representative household surveys and censuses and provide an overview of populations using different forms of drinking-water and sanitation.

The Global Annual Assessment on Sanitation and Drinking-Water (GLAAS)

The GLAAS reports on the capacity of countries to make progress towards the MDG water and sanitation targets and on the effectiveness of external support agencies to facilitate this process. The UN-Water GLAAS has been designed in response to the need to reduce the reporting burden and harmonize different reporting mechanisms of UN Member States. The UN-Water GLAAS initiative is technically coordinated by the World Health Organization (WHO).

UN-Water's strategy for moving forward

Since its creation in 2003, UN-Water has progressively developed and achieved a number of successes. First, it has promoted an increased coordination amongst its members and partners, which means better delivery of services to UN member states. Second, it has effectively developed and delivered reports, publications and tools that delineate the global water crisis and point to solutions. Third, it has developed and is following through with strategies to make an impact on specific and emerging concerns in the water arena, which range from climate change adaptation to country-level coordination. Fourth,

it has increasingly become a platform for interagency discussions on key issues and concerns, striving towards arriving at a consensus point of view which, in turn, will also help in achieving effectiveness of UN responses to the global water crisis.

While one may argue, perhaps correctly, that each of the achievements listed above could be viewed as work in progress, yet they also point to the potential further development of UN-Water. The processes and mechanisms that have evolved can be further put to serve the goals and objectives of the global community. It is imperative to point out that the overall goal of the UN-Water continues to be to promote increased collaboration and coordination amongst its members and partners as a way to provide better delivery of services to UN member states. The UN-Water members have identified the following three aspects as key to UN-Water's future development:

First, the UN-Water must continue its work to bring further coherence amongst its members and partners with the aim of better addressing the global water crisis. It means promoting a more strategic prioritization of the work of the various UN-Water activities, which should always add value. It also requires efforts to promote more active participation from all members as well as partners. Such engagement is particularly essential for the ECOSOC regional commissions, which play an important role of spanning the gap between the global policy formulation and country-level action.

Second, the UN-Water should be a major facilitator for inclusion of water in the global policy debates. At the moment, major global policy debates include a wide range of issues, namely: the global financial crisis, global climate change, the focus on food security worldwide, and numerous international peace and security concerns. Water is a central element to each of these issue areas, but is typically not seen as such and therefore ignored. An almost complete exclusion of water from the climate change adaptation debate is a case in point. There are a number of international forums, both within and outside the UN system, which shape the global agenda on these issues. These include the UN General Assembly and Security Council, the G8 Summit, and most recently the G20 Summit.

A recent debate in the UN General Assembly specifically targeted global water issues, but is yet to make strong connections to the other global challenges. Other processes, such as the negotiations within the World Trade Organizations, also have potentially vast impacts on water issues. UN-Water, with the collective wisdom of its members and partners, can become a strong voice in these debates. Effective interaction would require comprehensive thinking, cohesive development of system-wide rec-

ommendations and policies, and effective dissemination and interaction at the highest policy levels as well as on more operational levels.

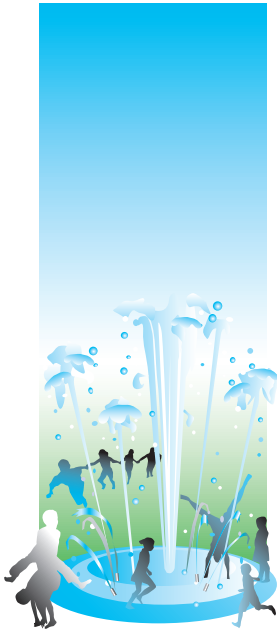
Third, UN-Water can support better delivery of relevant services by its members and partners at all levels but with a particular focus on the country level. Many member states, both recipient developing countries and donor developed countries, frequently express the desire to be better served by coordinated and coherent delivery of water services. The latter group includes the contributors to the UN-Water. The "One UN" initiative has made some inroads in this direction, but has demonstrated limited successes. A recent report of the UN Chief Executive Board details that much more action is needed for the UN system to evolve into "One United Nations" – the cohesive force for progress and change that current conditions require and that Member States have demanded, in putting forward the Millennium Declaration. This provides an opportunity to the membership of the UN-Water to demonstrate what delivering as one could mean in practice through the UN-Water. The country-level coordination task force has identified a number of ways in which the UN-Water can help, but these concepts remain to be tested on the ground. The UN-Water can, therefore, provide the conceptual constructs and policy guidance as well as case studies of how these can be made to work for the UN member states.

Challenges and opportunities for UN-Water

The task of coordinating actions of a number of members and partners is principally a daunting challenge. Over the years, the UN-Water has been on a steep learning curve to understand how to manage this critical task. The strategic directions identified in the previous section provide specific, targeted avenues through which collaborative action should take place. A number of new multi-partner initiatives have spawned, for example the Sanitation and Water for All (SWA) initiative, which offer the opportunity to bring together the resources of the UN-Water to address specific challenges. As the UN-Water continues to gain strength through its membership and through the support from donor countries, it is anticipated to rise to the challenges it faces. □

The Millennium Development Goals from the perspective of water*

Nikhil Chandavarkar and Helena Caballero



KEYWORDS

UNITED NATIONS
WATER
MILLENNIUM DEVELOPMENT GOALS
WATER SUPPLY
SANITATION
DECADE

Introduction

The signing of the Millennium Declaration in 2000 by 189 United Nations Member States, 147 represented by their heads of state, was a milestone for international cooperation in the 21st Century. In the Declaration, international development goals were collected together and a series of concrete and quantifiable development goals were adopted, known as the Millennium Development Goals (MDGs). Spurred on by the Declaration, governments of developing and developed countries committed to reaching these interrelated goals by 2015.

The MDGs are the most visible form of the internationally-convened development targets related to the United Nations' development programme and represent the culmination of many meetings organised by the United Nations over the previous decade on topics such as sustainable development, education, infancy, food, women, population and social development. The goals are quantitative and have fixed time limits, set by the world, for eliminating extreme poverty, hunger and diseases and for promoting gender equality, education and environmental sustainability. They are also an expression of basic human rights such as the right to health, education and housing. The eighth Goal considers the establishment of a worldwide alliance for development and includes commitments to providing development aid, improving the debt situations for developing countries, and trade and access to technologies.

The MDGs provide a historic framework for concentrating efforts and being held accountable for them. However, both the efforts and the accountability system are being strained and will have to be strengthened in order to achieve the MDGs by 2015. This is very important given that the MDGs are partial goals, key steps in the march

towards sustainable development for all. At the same time, the devastating impact of climate change is increasingly upon us and the international community must strive to work together to put an end to extreme poverty within the framework of sustainable development.

Water, just like air, is one of the essential elements of the Earth for human life, fauna, flora and ecosystems. Fresh water is the theme of a large number of international and regional agreements and also the internationally-agreed MDGs. Access to clean drinking water and sanitation are vital elements to achieving the majority of the MDGs, such as eradicating poverty, combating hunger and improving health.

This is a crucial year. The Secretary-General of the United Nations convened the Member States to a high-level summit in September to review progress towards the MDGs agreed by the countries in 2000 in the "Millennium Declaration" where the Member States of the United Nations established their commitment to development and their respective responsibilities as a whole and as individual sovereign nations.

All the MDGs are related in some way to the presence or lack of water, however the most important specific objectives in the Declaration relating to fresh water are:

- a) By 2015, reduce by half the proportion of people living on less than a dollar a day and reduce by half the proportion of people suffering from hunger; Also by this same date, reduce by half the proportion of people who lack access to drinking water or sanitation or who cannot afford it.
- b) To stop the unsustainable exploitation of water resources, by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies.



Fig. 1. Clothes being washed with water obtained from a well dug in the dry riverbed. Niger. January 1983. Source: UN Photo/Jeffrey Foxx.

In early June in Dushanbe, the capital of Tajikistan, progress of the International Decade for Action “Water for Life” 2005-2015’s activities was reviewed, since it was the halfway point of said Decade and its end date coincides with the deadline for the MDGs. The Decade was simultaneously promoted. Its main objective is to promote activities leading to the fulfilment of international commitments relating to water and related areas for 2015, so that it may be a decade for action.

The MDGs and water: An approach to evaluating their fulfilment

At the halfway point of the 2005-2015 decade and two thirds through the period established to achieve the MDGs, it is important to evaluate what progress have been made on the agreed commitments, and evaluate progress on the targets set within each goal. There are still challenges to overcome to achieve the MDGs; however there are measures which have been shown to be effective and also structural changes which have been important in facilitating progress. Water is presented as a unifying element throughout and, in many cases, is the key to achieving all the MDGs. It is a point which has, arguably, not been stressed enough as this article aims to show.

Progress on achieving Goal 1: “Eradicate extreme poverty and hunger” Target: “Halve by 2015, the proportion of people whose income is less than \$ 1 a day”

Since 1990, the number of people living in extreme poverty has been reduced from half the world’s population to a little more than a quarter in 2005, however there



Fig. 2. Young girl refills water pot. Well refurbished by UNICEF to make clean water accessible to villagers. Côte d’Ivoire. March 2008. Source: UN Photo/Ky Chung.





Fig. 3. Children fill their containers with water from a community pump on the dry Tihama plain, Hodeidah. Yemen Arab Republic. January 1985. Source: UN Photo/Ian Steele.

are still more than 1 billion human beings subsisting on less than a dollar a day, and many regions of the world have a long way to go to achieve this Goal.

According to the UN Water's *World Water Development Report 2009*, problems of poverty are *directly related to those of water* –its availability, proximity, quantity and quality. Providing better access to water for poor people would be an important step towards eradicating poverty. The construction of wells and water pumps creates significant, beneficial side-effects. Surplus water tends to be used to water family plots which provide a sustainable source of vegetables which adds nutritional variation to their diet. Development specialists also recommend the use of latrines with pits for making fertiliser to provide a free, viable and sustainable alternative to expensive, and often contaminating, fertilisers.

Target: "Reduce by half the proportion of people who suffer from hunger"

The high price of food limits progress towards the eradication of hunger: The incidence of malnutrition, which had been falling for 18 years, is now rising again due to the increased cost of food. The number of conflicts and displacements caused by hunger is also growing. The number

of countries where children reach their minimum weight has risen, however today there are 840 million malnourished people and 100 million more suffering from hunger.

According to the *United Nations World Water Development Report*, a large number of malnourished people live in environmentally-degraded rural areas and in marginalised urban areas. Wars and natural disasters such as *floods and droughts* are the main causes of malnutrition. In order to reduce the level of hunger worldwide, the World Water Assessment Programme has identified three water-related challenges: *Satisfying basic needs, valuing water and ensuring the provision of food.*

Progress on achieving Goal 2: "Achieve universal primary education"

Target: "Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling"

The enrolment rate for primary education has risen from 83% in 2000 to 88% in 2007. School attendance, particularly among girls, is affected by time-intensive tasks such as *carrying water*, and factors such as poor health. Lack of adequate sanitary installations in schools has been shown to be an obstacle to girls' attendance, particularly when they are menstruating.



Fig. 4. Water distribution in Tora, Northern Darfur. The closest water source is 1.5 hours away the village. Darfur. July 2009. Source: UN Photo/Olivier Chassot.

This Goal will not be achieved if national educational systems are not strengthened by increasing spending on education in each country –15% to 20% of the national budget–, prioritising basic education, and promoting stable employment and ongoing training for the teachers.

Progress on achieving Goal 3: “Promote gender equality and empower women”

Target: “Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015”

The available data shows that 60% of countries have achieved gender equality in primary education, 30% at secondary level and just 6% for higher education.

Women’s relationship with water is very clear: *Many girls cannot go to school because they are in charge of collecting water for the home and because there are not separate bathrooms for girls in many educational establishments.*

Also, it is vital that women actively participate at all stages of community projects: They have detailed knowledge of local sources of water and, given that they will be the main users of future water provision points, are the ideal people to choose the best location for them. Water-related activities, such as agricultural development pro-

jects, have a much better chance of success when women participate in them rather than being excluded. Furthermore, women frequently take on the role of community teachers on matters of hygiene.

However, there is more that should be done: This target will not be achieved without reducing women’s work load, reducing girls’ domestic responsibilities and educating them on how to avoid adolescent marriage and pregnancy.

Progress on achieving Goal 4: “Reduce by two thirds the under-five mortality rate”

Target: “Reduce by two thirds, between 1990 and 2015, the under-five mortality rate”

There have been two major achievements for this goal: The number of deaths among children under five has fallen from 12.6 million per year (1990) to 8.8 million (2008).

The connection between access to drinking water and infant health is dramatic and direct: *Non-drinking water and unhealthy sanitary and hygiene habits lead to the death of 1.5 million infants under five every year (5,000 every day), and, of the total number of diarrhoea-related deaths in 2001, 70% were children.* It has been proven beyond doubt that children’s health improves when development



projects provide education on hygiene, drinking water and sanitation. Furthermore, children have the time to attend school, receive an education, or simply, play.

**Progress in achieving Goal 5:
"Improve maternal health"**

Target: "Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio"

This is the MDG where least progress has been made: In developed regions nine maternal deaths are recorded for every 100,000 live births, while in developing regions that figure is 450.

Access to drinking water and sanitation is vital to reduce the maternal mortality rate. One woman in every 48 dies during or after childbirth, women often cannot wash themselves, nor their baby.

Access to drinking water and sanitation helps women minimise the chance that they or their baby will contract an illness or die.

Low cost access to a clean water supply and basic sanitation services is one of the most effective measures for improving maternal health; however we must remember that these should be national health strategies and international aid should be invested in training professionals in these countries.

**Advances in Goal 6:
"Combat HIV/AIDS, malaria & other diseases"**

Target 1: "Have halted by 2015 and begun to reverse the spread of HIV/AIDS"

Target 2: "Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it"

A lot has been achieved in the fight against this disease: The number of new HIV infections in the world reached its height in 1996 and since then has fallen by 30% to 2.7 million in 2007. In just five years, the coverage of antiretroviral drugs in poor countries has doubled.

Having clean water and basic sanitation contributes to the prevention of diseases associated with water, including diarrheic illnesses which can be fatal. The annual death toll due to diseases linked to poor water quality is 6 million

people. People weakened by HIV/AIDS have a greater chance of suffering due to the lack of clean water and sanitation, particularly because diarrhoea and diseases of the skin are two of the most common infections. However there are still 33 million people living with HIV and what is worse still is that in 2007 for every person who started a regimen of antiretroviral drugs, three new people were infected with HIV.

Target 3: "Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases"

Malaria is a vector-borne disease closely linked with water. There are more than 300 million severe cases every year that lead to the death of more than 1 million people, 90% of them in Sub-Saharan Africa. In this part of the world, the use of mosquito nets treated with insecticide to protect children, a highly-effective, low-cost measure, has risen from 2% in 2000 to 20% in 2006. The incidence of tuberculosis is also stabilising. However, to achieve this Goal, sanitary strategies must be put in place at a national level, establishing a basic but wide social assistance network, prioritising certain regions and vulnerable and marginalised groups and paying special attention to the poor, the rural population, women and young people, and aiming to guarantee the protection of the health of the most needy and excluded.

An improved water supply also reduces the risk of the transmission of malaria and dengue fever.

**Progress on achieving Goal 7:
"Ensure environmental sustainability"**

Target 1: "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources"

Among the main challenges related to water defined by the World Water Assessment Programme are those of protecting ecosystems (*since 1900, around 50% of the world's wetlands have been lost*), satisfying basic needs and providing water services to cities. It is just as worrying to note that the percentage of exhausted or overexploited fishing reserves has risen from 70% in 1995 to 80% in 2006.



Fig. 5. UNOCI troops distribute water, Bouake, Côte d'Ivoire. January 2007. Source: UN Photo/Basile Zoma.



Fig. 6. Young girls fetch water at communal water pump drilled by UNICEF, Tanzania. June 2006. Source: UN Photo/Evan Schneider.



Fig. 7. Children helping an old woman fill her containers with water from a community pump in Dobra Khira near Sanaa, Hodeidah. Yemen. January 1985. Source: UN Photo/Ian Steele.



Fig. 8. A young boy getting a drink of water from an open pipe on the streets of Port-au-Prince. Haiti. May 1997. Source: UN Photo/Eskinder Debebe.

With respect to climate change, in spite of the 195 countries presently participating in the Montreal Protocol having managed to reduce their use of ozone-depleting substances by 97%, the continual increase in greenhouse gases is an alert to the seriousness of the problem of climate change. In 2004, due to fires, the forestry sector contributed 17.4% of the total amount of greenhouse gases emitted. The net amount of deforestation is declining, however the pace of deforestation is alarming: approximately 13 million hectares a year. Regions reporting the the largest net loss of forest areas in the world are Sub-Saharan Africa, Latin America and the Caribbean.

In order to protect the environment, countries should be encouraged to create Sustainable Development Strategies based on educating the population so they can participate in development decisions.

Target 2: “Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss”

The United Nations declared 2010 the International Year of Biodiversity. There are still 17,000 plant and animal species in danger of extinction and the trend has not slowed. Today, only 12% of the planet has some kind of protection. Many more efforts are needed to protect the threatened species and ecosystems and recognising the traditional rights of indigenous people to natural resources should be included among the most basic measures.

Target 3: “Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation”

The world is ahead of schedule for the target of providing access to safe drinking water for 2015: 87% of the world population (5.9 billion people) already use water fit for drinking; some 1 billion more people now have access to drinking water since 1990, almost half of them in China and India. However 884 million people in the world still do not have access to drinking water of high enough

quality for human consumption, they use unimproved water sources for drinking, cooking, bathing and other domestic tasks, and the majority live in rural areas. The outlook is not so good regarding access to basic sanitation: 1.3 billion people have gained access to sanitation since 1990, the majority in North Africa and East and South-east Asia, however 2.6 billion people (42% of the world population; or four out of ten people) still do not have access to basic sanitation services. In 2015 this figure will rise to 2.7 billion due to population growth and in spite of the health risks to them and their families, 1.2 billion people (18% of the world’s population) still defecate outdoors.

It is necessary to promote access to low cost supplies of clean drinking water and public sanitation services by building an infrastructure suited to the size of the community. It is estimated that an additional investment of 11.3 billion dollars a year will be needed in order to achieve the MDGs related to drinking water and sanitation at a basic level.

Target 4: “By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers”

Over the last few years percentage of the population living in slums has declined from 50% to 36%, but there are still 1 billion people living today in marginalised areas; in some countries the inhabitants of these slums comprise 40% of the total urban population. This figure could rise to 2 billion by 2020. Sub-Saharan Africa is the region with the highest number of slum dwellers and their number is growing, however Latin America is the region with the greatest inequalities. It is vital to promote full-service urban planning in order to eliminate slums.

Progress on achieving Goal 8: “Develop a global partnership for development”

According to the *World Water Development Report*, many governments, concerned about debt and deficit reduction, have made significant reductions in spending on their in-



infrastructure and environment-related services over the last decade. The coverage of clean drinking water provision will represent a substantial cost for all the countries, of between 10 and 30 billion dollars a year, along with the costs they already cover. The global recession has increased the price of existing loans and has lowered the capacity of developing countries for investing in education, sanitation or infrastructure. The only countries to have achieved or surpassed the target set by the United Nations (0.7%) were Denmark, Luxemburg, Norway, the Netherlands and Sweden. In reality, aid for the poorest countries is a lot lower than the target set for 2010.

Global collaboration and partnership should be used to provide support for national development strategies and for capacity-building activities in each country. Donors, including emerging donors, and the countries receiving the loans should hurry towards harmonisation and alignment, results-based management and mutual accountability of the resources. The Member States of the World Trade Organization (WTO) should strengthen their commitment to finalising the Doha Development Round development treaty and less developed countries (LDC) should join the WTO; developed countries should allow tariff and allowance free access for at least 97% of the products imported from the least developed countries. Developed countries should also fulfil the promise they made in 2005 of eliminating all export subsidies by 2013, including those for agriculture, which continue to be a significant distortion affecting trade and agricultural production in developing countries.

The way forward

The Millennium Declaration set 2015 as the deadline to achieve most of the MDGs. The MDGs establish quantitative measures for halving extreme poverty in all its forms. Today, less than five years before the deadline, progress towards these goals is threatened by an unprecedentedly severe and widespread global economic crisis, slow or even negative economic growth, fewer trade opportunities for developing countries and reductions in aid from donor countries. Furthermore, the effects of climate change are becoming more clearly felt every day and could have devastating effects as much for the richer countries as poorer ones.

The International Decade for Action “Water for Life” 2005-2015, was approved by the General Assembly of the United Nations in Resolution 58/217 on 9 February, 2004. The main goal of the Decade is to promote efforts that help achieve water-related international commitments and related areas by 2015; it aims to keep international attention and political will in favour of the water and sanitation-related aspects of the programme at all levels during the Decade. Corresponding commitments include the MDG of halving the proportion of people lacking access to drinking water



Fig. 9. Pakistan flood victims access safe drinking water. UNICEF is providing safe drinking water to flood victims in accessible areas of Khyber-Pakhtunkhwa province. August 2010. Source: UN Photo/UNICEF/ZAK.



Fig. 10. Clean drinking water runs from a faucet in Senegal. June 2006. Source: UN Photo/Evan Schneider.

and basic sanitation by 2015. The Decade’s activities are organized around several central themes with the goal of promoting sustainable development and reducing poverty: food, health, environment, disaster prevention, energy, water-related cross-border issues, drought, culture, sanitation, contamination and agriculture. The Decade also concentrates on encouraging countries to end the unsustainable exploitation of water resources and promote the creation of integrated management plans that make efficient use of water resources by 2005 as agreed in the World Summit on Sustainable Development in Johannesburg, South Africa.

In June in Dushanbe, the capital of Tajikistan, levels of implementation of goals established by the United Nations were reviewed, 2005-2015 having been designated the decade for action on water management. The High-Level International Conference in Dushanbe based its in-depth deliberations on six areas: accelerating progress towards the goals contained in water-related international agreements, including the MDGs, ensuring the participation of women; transnational cooperation for water; water quality; water resources, reducing the risk of disasters and adapting to climate change; sustainable finance; and integrated management of water resources, along with energy, agriculture and food security. Many important achievements were cited from the first five years of The International Decade for

Action “Water for Life” 2005-2015, regarding the application of water-related programmes and projects. These achievements were possible thanks to many efforts from developing countries, donor countries, the United Nations, international organisations and non-profit organisations.

However, there are still major obstacles as a result of emerging challenges and issues arising from the recent world crises, among them: energy, food and financial crises, together with the growing impact of climate change. Within this context it became clear that water resource management should be tackled at local, national, regional and international levels. All stakeholders, including governments, international organisations, the private sector, non-profit organisations and universities should be involved, also women’s participation and involvement in water-related development efforts should be ensured, so they can all work together to achieve the goals set out in The International Decade for Action “Water for Life” 2005-2015, according to the Assembly-General in its 58/217 Resolution.

However at the end of this year there was another important date to promote the MDGs: With only five years until the 2015 deadline for achieving the MDGs, the Secretary-General of the United Nations, Ban Ki-moon, made a call to leaders of the world to attend a summit in New York from 20th to 22nd of September to speed up progress on achieving the Goals.

The objective of this high-level summit in September 2010 was aimed to examine progress on targets and to agree on an action plan to achieve the MDGs. With five years until the 2015 deadline, the possibility of failure to achieve these goals due to lack of commitment is very real.

The lack of progress on the MDGs is not because they are impossible to achieve, nor because the timeframe is too short, rather it is due to unkept promises, insufficient resources, dispersion of efforts, lack of accountability and insufficient interest in sustainable development. These have been the reason why not everything has been done with regard to finance, services, technical support and alliances, and the situation has been worsened by the food and international economic crises and by the failure of many policies and development programmes. As a result, any improvement in the standard of living for the poorest people has been unacceptably slow, and furthermore, some of the costly progress that had been made is being eroded.

The MDGs represent a pact, not just between governments, but between everyone interested in development. Every agent must strive, above all, to make full use of their resources and to act efficiently and in unison on their specific role. Developing countries should establish policies and institutions to achieve the MDGs, with governments, communities and citizens all working together. Through South-South cooperation, they must also commit to helping other

developing countries through the transfer of knowledge, technology and resources. Agents from non-profit organisations, including those who ensure the accountability of governments and service providers, should commit to completing the MDG programme. Private companies should provide technology, create meaningful job opportunities and work in other capacities to support the MDGs. Private philanthropic contributions should play a catalysing role by promoting innovation which later may be adopted by the public sector and by creating alliances between the public and private sector. Developed countries should comply with any commitments already made in order to increase the quantity and effectiveness of development aid and improve access to markets for exports from development countries. The multilateral system, which includes organisations, funds and United Nation programmes, should improve their coherence and efficiency to support the DMGs. The promise of providing adequate help remains unfulfilled and, as a result of the present world recession, it is more urgent than ever to ensure the international financial system and international trade system provide support for development; the guarantee that resources can be made available is a decisive factor for successful development, MDGs included.

The thousands of millions of people hoping the international community will honour the promise of the Millennium Declaration to create a better world cannot be disappointed. If we fail, the dangers faced by this world will multiply: instability, violence, epidemics, environmental deterioration and uncontrolled demographic growth. This failure would be unacceptable, both morally and practically.

The MDGs Summit, held in September, was aimed to reaffirm the commitments made at the start of the millennium and unite wills to speed up progress. □

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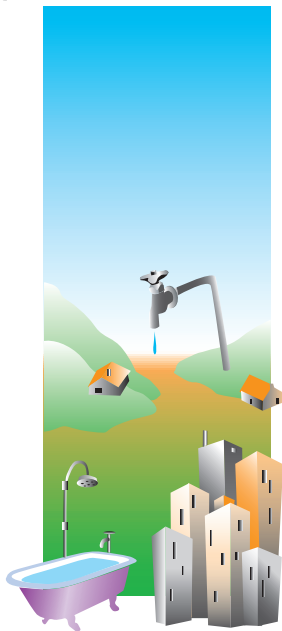
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Note

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- MDG, Annual Report 2009 <<http://www.un.org/millenniumgoals/>>.
- MDG Task Force Fact Sheets: <<http://www.un.org/esa/policy/mdggap>>
- A/64/665: Keeping the promise: *A forward-looking review to promote an agreed action agenda to achieve the Millennium Development Goals by 2015*, Report of the Secretary-General, 12 February 2010.
- A/64/694: *Water and the internationally agreed development goals*, Note by the Secretariat, 5 March 2010.





Financing sanitation and water in Latin America and the Caribbean

Getting off-track countries on track to meeting the MDG target

Sue Cavill, Federico Properzi and Peregrine Swann

KEYWORDS

DRINKING-WATER
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Introduction

This article reviews progress towards the Millennium Development Goal (MDG) water and sanitation target in Latin America and the Caribbean (LAC) based on the findings of the World Health Organization (WHO) / United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation (JMP) and of the UN-Water Global Annual Assessment of Sanitation and Drinking-Water (GLAAS).

The JMP is the official United Nations mechanism tasked with monitoring progress towards the Millennium Development Goal (MDG) target on drinking-water and sanitation (MDG Target 7c), which is to: "Halve, by 2015, the proportion of people without sustainable access to safe drinking-water and basic sanitation".

The GLAAS is a UN-Water initiative led by WHO. Its purpose is to provide a deeper understanding of the drivers for, and obstacles to, progress by integrating JMP data with financial, institutional capacity and human resource capacity data. The UN-Water GLAAS surveys are carried out in LAC through the Pan American Health Organization. In 2010 country submissions to UN-Water GLAAS were received from Paraguay, Honduras, and Bolivia.

Context

Achieving the water and sanitation target of the Millennium Development Goal 7 not only lowers health-care costs, but also increases school attendance, promotes gender equity and boosts productivity and economic growth. Yet the latest figures suggest that 20% of people (or approximately 115 million people) in the LAC region live

without access to improved sanitation facilities. Regionally, 7% (or 40 million people) do not get their drinking-water from improved water sources.

Progress in LAC towards the MDG water and sanitation target

The JMP reports on the use of improved facilities. An improved drinking-water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact.

At the current rate of progress the world is expected to exceed the MDG water target. Nonetheless, in 2008 it is estimated that, globally, 884 million people did not use improved sources of drinking water. As a region, Latin America and the Caribbean is on-track to meet the water MDG target: since 1990, 167 million people in Latin America and the Caribbean have gained access to a piped connection on their premises. The number of people relying on unimproved sources has declined from 15% to 7% of the population.

However, significant differences between urban and rural areas are found even when countries have achieved relatively high coverage. For example, in the region 92% of people in urban areas have piped water on their premises, while in rural areas 58% of people have piped water on premises. Moreover, much remains to be done in terms of

improving the quality of drinking water, reducing the pollution of surface and groundwater, as well as in reducing the problems of leakage and intermittent service.

Sanitation, on the other hand, is one of the most off-track MDG targets globally. According to the latest estimates, in 2008 there were 2.6 billion people worldwide that have no access to basic sanitation and 1.1 billion people that still defecate in the open. At the current rate of progress the world will miss the MDG target so that in 2015 there will still be 2.7 billion people without access to improved sanitation. The lack of sanitation impacts, in a very direct way, progress on all other MDGs, particularly those on maternal, new-born and child health which are also off-track.

The LAC region is making good progress towards meeting the MDG target in use of improved sanitation: 86% of urban population has improved sanitation compared to 55% of rural population – 20% of people practice open defecation in rural areas. However, there is a great deal of diversity at the country level. For example, at the low coverage end are countries such as Haiti with

only 17% of its population using improved sanitation facilities, contrasting with others such as Barbados, Uruguay and Bahamas with total coverage and countries like Ecuador (92%), Cuba (91%), Chile (96%), and Paraguay (70%) with extremely high coverage levels in 2008 and close to meeting their 2015 targets. In Bolivia (25%), Colombia (74%) and Venezuela (89%) progress has stagnated, making the MDG goals difficult to achieve. In the case of sanitation much remains to be done in terms of increasing coverage and use of basic sanitation, service quality, affordability and the treatment of urban sewage to prevent the pollution of surface and groundwater.

The burden of water related disease

The figures on access and use of water and sanitation have great implications on health. Around 10% of the total burden of disease worldwide could be prevented by improvements related to drinking-water, sanitation, hygiene and water resource management (Prüss-Üstün, 2008). Globally, diarrhoea is the second leading cause of death

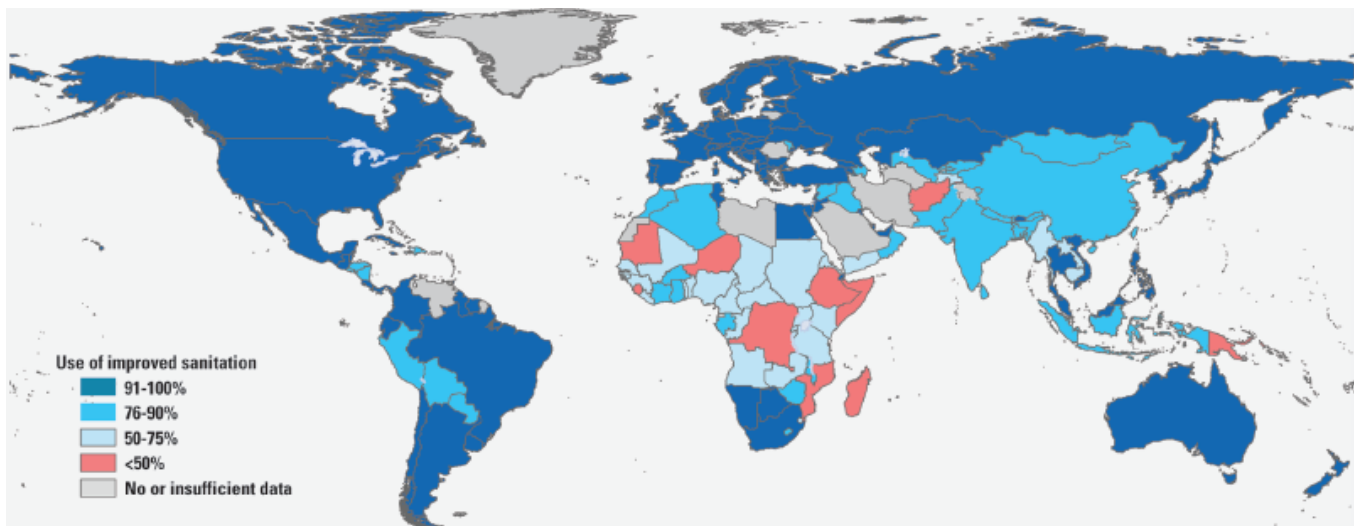


Fig. 1. Use of improved drinking water sources in the LAC region, 2008. Source: WHO/UNICEF (2010).

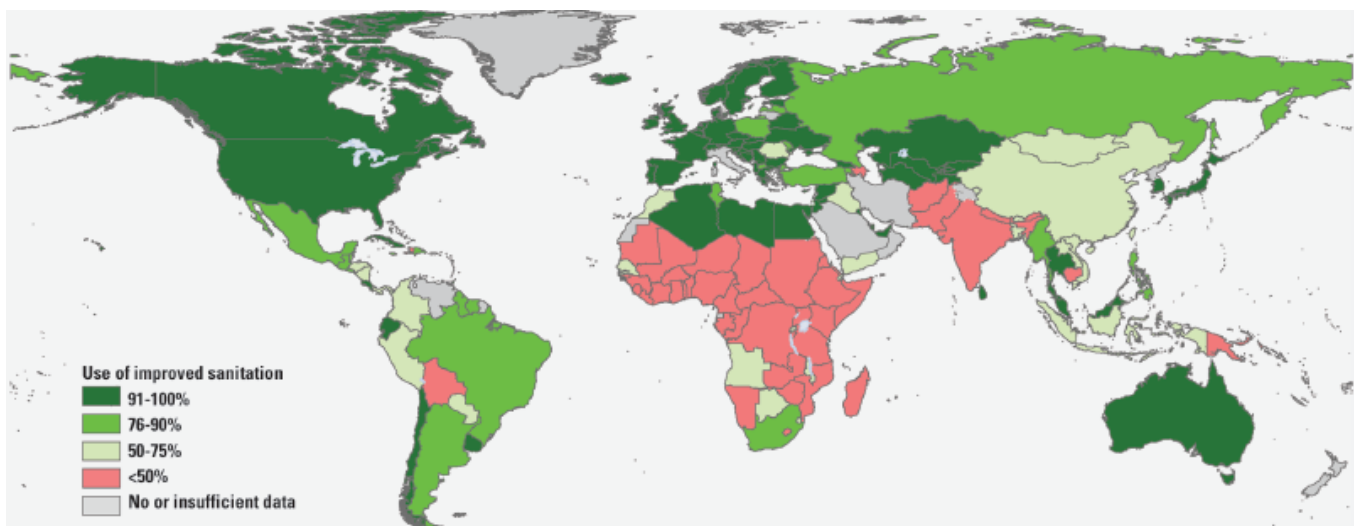


Fig. 2. Use of improved sanitation in the LAC region, 2008. Source: WHO/UNICEF (2010).



among children under five globally (WHO/Unicef, 2009)! According to Lvovsky (2001), about 5.5% of the loss of disability-adjusted life years (DALY) in Latin America and the Caribbean is due to deficiencies in drinking water supply and sanitation services, compared to 1.0% in the industrialized countries and 7.0% in the developing countries (quoted in Jouravlev, 2006).

An estimated 50% of underweight or malnutrition is associated with repeated diarrhoea or intestinal nematode infections as a result of unsafe water, inadequate sanitation or insufficient hygiene. In addition, neglected tropical diseases (NTDs) such as Chagas disease, trachoma, schistosomiasis, dengue fever, leishmaniasis, lymphatic filariasis, onchocerciasis and helminths – most of which are associated with inadequate water, sanitation and hygiene – affect over one billion people globally. One study (Hotez et al, 2008) found that neglected tropical disease as a group may have surpassed HIV/Aids, tuberculosis and malaria as the most prevalent infectious disease in Latin America and the Caribbean; with NTDs as the most common infections of approximately 200 million of the poorest people in the region (Hotez et al, 2008).

The two most effective interventions to reduce diarrhoea morbidity in children under 5 are hand washing with soap (37%) and improved sanitation (34%) (3IE, 2009). The most effective intervention is a multiple intervention composed of point of use water treatment combined with sanitation and/or hygiene promotion.

The cost-benefit of investments in water and sanitation

Access to water supply and sanitation reduces health care costs, increases school attendance, frees time for productive activity, and ensures gender equity, which in turn generates benefits for the economy as a whole. It has been estimated that every US\$1 invested in providing sanitation produces US\$9 of the economic benefits (Hutton et al, 2006). This can translate into significant benefits for the economy. Annual economic benefit estimates for achieving the MDG sanitation target in the “off-track countries” indicate that US\$35 billion can primarily be attributed to non-health benefits; predominant in saved time due to better access to sanitation facilities.

Improved water supply facilities, sanitation and hygiene interventions are among the top most cost-effective in averting DALYs related to diarrhoeal disease (disability-adjusted life years): hygiene promotion is the most cost effective intervention against diarrhoeal disease (including hand washing) at US\$3.35 per DALY averted (Cairncross and Valdmanis in Jameson et al, 2006).

The economic costs of neglecting investment in the sanitation and water sector, on the other hand, are high-



Fig. 3. Peru tanker truck. Source: WHO.



Fig. 4. Colombia polluted water. Source: WHO.

lighted by studies in South-East Asia that found the total economic losses associated with poor sanitation alone are equivalent to 7.2% in Cambodia and 5.4% in Lao PDR (World Bank, 2008a). Another study found the health costs directly resulting from poor sanitation and water cost the country the equivalent of 2.1% of annual GDP in Ghana (World Bank, 2008b).

The region has direct experience of the costs of a deterioration in drinking water supply, sanitation and health services. In 1991 an epidemic of cholera in Peru spread to various other countries in Latin America (Bolivia, Brazil, Canada, Chile, Colombia, Ecuador, El Salvador, French Guyana, Guatemala, Honduras, Mexico, Nicaragua, Panama and Venezuela). The epidemic was reported to have caused as many as 4,000 deaths and serious losses in tourism, agriculture, fishing and trade with countries in the region – particularly of products of marine and vegetable origin (Jouravlev, 2006: 16).

Setting the LAC region in the global context How is LAC similar?

Like much of the world still more progress is needed in LAC to reach the poorest people – slum dwellers, rural populations, and indigenous people. Although there are variations between countries within the region, as interna-

tionally, the achievement of the MDG sanitation target is a key challenge facing Latin America and the Caribbean. Greater action is required to ensure that countries with low initial coverage, that have the potential or are likely to meet the goals, manage to effectively reach the expected reduction in uncovered population.

How does it differ?

It has been argued that the JMP definition of *improved sanitation* for LAC should be more localized and country-specific, since the region has a higher level of economic development than many other developing countries. The level of service usually conceived for sanitation in urban centres of the region is household connection to sewerage systems, linked to treatment and final disposal of waste water. For instance, in Paraguay service definitions require sewerage in urban areas, and at least a septic tank and soakaway for rural families. Moreover, the region also has a good track record of adapting technologies to increase access to water and sanitation, for example rope pumps, simplified sewerage, and condominal systems have been successfully developed and implemented in some LAC countries to increase access to services at a cheaper cost to build and operate. There is very little regional information available on wastewater treatment systems: it was estimated in 2000 that only 13.7% of wastewaters from the 241 million inhabitants whose homes are connected to sewerage networks, receive some degree of treatment (Jouravlev, 2006: 18).

Sector financing

How much will it cost?

It is acknowledged that, on average, a significant increase in investments is needed to achieve the Millennium Development Goal water and sanitation target, including in the LAC region.

Hutton and Bartram (2008) estimated that, globally, from 2005-2014 approximately US\$70 billion needs to be spent annually on water and sanitation to meet the targets of the MDG goal, of which US\$ 18 billion is on increasing coverage to the currently unserved population, and US\$ 52 billion is on maintaining and renewing existing facilities for populations already with water supply or sanitation coverage. Table 1 and 2 show the regional per capita costs of attaining the water supply and sanitation, which are relatively higher in Latin America and the Caribbean.

The World Bank (Fay and Yepes, 2003) has estimated that the investments needed to increase access to achieve the MDGs in water and sanitation in Latin America by itself is 0.12% of GDP, not including maintenance and rehabilitation, which may be substantial and of course key to ensuring sustainability of the service.



Fig. 5. Nicaragua water pipes. Source: WHO.



Fig. 6. Nicaragua public standpost. Source: WHO.



Table 1		
Per capita costs of water improvement in LAC, excluding programme costs		
Per capita costs (US\$ year 2005)		
	Initial investment cost	Annual recurrent cost
Household connection (treated)	232	14.6
Standpost	66	0.7
Borehole	89	0.6
Dug well	77	0.5
Rainwater	58	0.4
Average of non-household connection options	72	0.5

Source: Hutton and Bartram (2008).

Table 2		
Per capita costs of sanitation improvements in LAC, excluding programme costs		
Per capita costs (US\$ year 2005)		
	Initial investment cost	Annual recurrent cost
Household connection (partial treatment)	258	11.0
Septic tank	258	6.8
Pour-flush	97	5.7
VIP	84	3.8
Simple pit latrine	97	3.9
Average of non-household connection options	134	5.0

Source: Hutton and Bartram (2008).

Another study (Inter-American Development Bank, 2005) suggests for Latin America and the Caribbean to meet the drinking water MDG target would require US\$16.5 billion in investments between 2000 and 2015, with Brazil and Mexico accounting for over 50% of the total funds required in the region. Of this amount 93% is allocated to urban areas and 7% to rural areas. This study estimates that the average cost of providing an individual with access to improved drinking water is US\$135.50.

That study also estimates that achieving the MDG sanitation target would require investing a total US\$22 billion between 2000 and 2015, an average of approximately US\$1.5 billion per year, nearly 50% more than the amount required to meet the targets for drinking water. Of these funds, 95% will be allocated to providing improved sanitation service to the urban population, and the remaining 5% to rural population service. According to this study, the average cost is US\$157 per person.

For example, on a country basis, Paraguay has surpassed the water MDG target of coverage of 65% by 2015. In 2008 coverage stood at 86%, however, as the population grows, GoAL WaSH (UNDP, 2009) estimates that to maintain the 65% coverage goal for 2015 it will be necessary to invest approximately US\$81 million in new systems, and US\$330 million in upgrading and rehabilitating existing systems.

For the UN-Water GLAAS 2010 report participating countries were requested to estimate whether the financial flows to sanitation and drinking-water were adequate to finance the achievement of the MDG target. Paraguay reported a decreasing trend with less than an estimated 50% of what is required to meet the MDG target in drinking water in urban areas and sanitation in both urban and rural. Honduras reported having between 50%-75% of financial flows sufficient to meet the MDG needs. Although both Honduras and Paraguay indicated insufficient funds, according to JMP estimates, both are "on track" to reach the MDG target in sanitation or drinking-water.

Financing models and instruments for water and sanitation services

As a region, LAC is notable for the large number of different financing models applied - with varying degrees of success - in the water and sanitation sector. The different models range from privatisation of the wastewater treatment system as adopted in parts of Chile from 1998 to 2004 (while almost universal drinking water supply and sewerage coverage was achieved with public finance); partially successful concession contracts, such as in La Paz-El Alto (Bolivia) or Buenos Aires (Argentina); national public sector provision (Costa Rica, El Salvador, Haiti, and Paraguay) and delivery of water and sanitation in rural areas by community organizations (although usually with public, central government financing). More recent innovations include microfinance - for example Mibanco (a Peruvian microfinance institution) offers loans to community members to upgrade water, electricity and road infrastructure in their neighbourhoods - and innovations to lower the cost of commercial banks' loans to municipal borrowers, for instance FINDETER (*Financiera de Desarrollo Territorial*) was set up in Colombia to attract commercial bank financing into local infrastructure. Output based aid (OBA) has been used to some extent in the region to expand water coverage via connection subsidies (examples include Paraguay and Honduras), to improve affordability for targeted groups via consumption subsidies (as in Chile or Colombia) and in Brazil a Federal government program (PRODES) adopted an OBA approach to finance the building of new or the upgrade of existing wastewater treatment plants (Evans et al, 2010).

The region receives a considerable proportion of the non-concessionary aid (i.e. "other official flows" not classified as Official Development Assistance) provided by the development banks to drinking-water and sanitation - but this is still small in comparison with sector financing needs. Globally non-concessionary finance increased

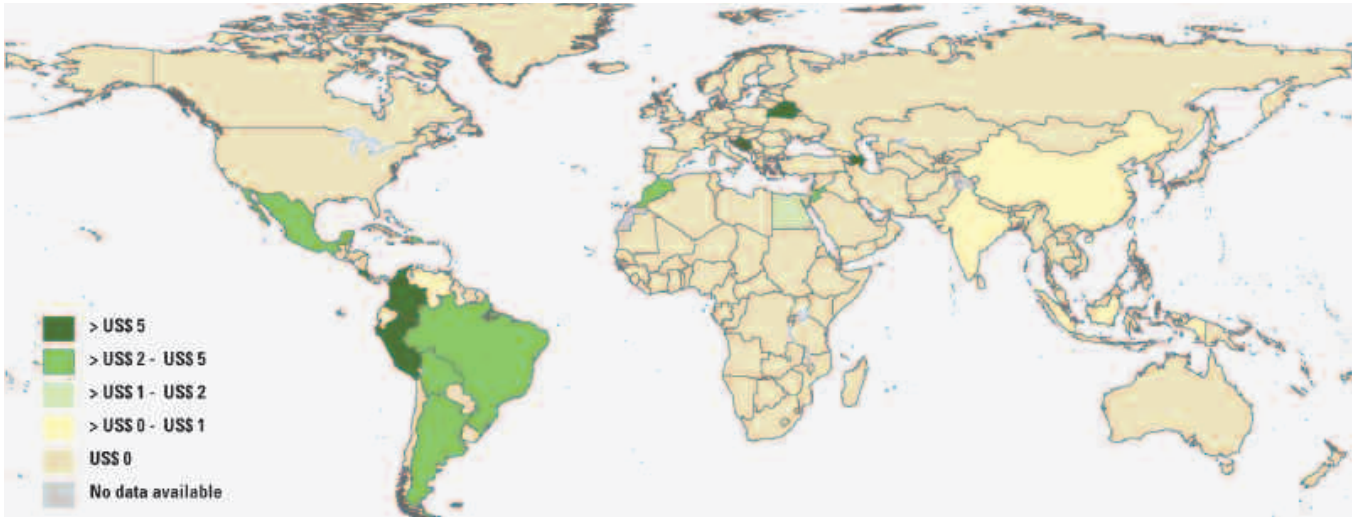


Fig. 7. Non-concessional loan commitments per capita made to sanitation and drinking-water, 2008.
Source: UN-Water GLAAS 2010 report, based on OECD data (WHO, 2010).

from US\$ 2.0 billion in 2006 to US\$ 3.3 billion in 2008, a 61% increase over the two-year period. LAC countries received around \$ 2 billion of this total amount.

World Bank funded OBA project in Paraguay

Alongside the public urban water utility (Empresa de Servicios Sanitarios del Paraguay), aguateros (informal, small private providers) served around 9% of the country's population in 2004 – or about 17% of all Paraguayans – with piped water supply. A pilot output-based aid program has been implemented by the rural water agency in Paraguay (Servicio Nacional de Saneamiento Ambiental) to enable aguateros and local construction companies to reach unserved communities and rapidly expand rural coverage encourage to serve small towns.

Source: Drees, Schwartz and Bakalian (2004: note 270).

The main financing instruments used in the water and sanitation sector can be broadly categorized as tariffs, tax, or transfers i.e. the 3 Ts (Trémolet and Scatasta, 2010):

- **Tariffs:** A primary source of revenue is from tariffs and other user charges. One estimate for the region suggests that water tariffs in Latin America are the highest of any region of the developing world (Komives et al, 2005) – however they may still be set below cost recovery levels and collection rates may be poor, resulting in little financial sustainability of services.
- **Tax:** Central and other governments may finance water systems through national taxes by: paying directly for the water supply and sanitation service; distributing part of central tax revenue to support local authority spending on water and sanitation services; providing cheap loan finance for local authorities to use for capital investment; or collecting part of the water charges centrally and redistributing it to authorities to invest (Hall, 2004). Water and sewerage can also be financed by local government out of local taxation, such as property tax (Hall, 2004).
- **International Transfers:** Financial aid can be in the form of grants, concessional loans or credits and may cover a good proportion of national (government and external,

but not including household) spending on sanitation and drinking-water – in some countries, near 90%. Although it is acknowledged that transfers such as loans must be repaid from taxes or tariffs so they are not a net source of funds for the sector. In 2008, the grant and loan aid commitments of external support agencies to sanitation and drinking-water amounted to more than US\$ 7.4 billion (as reported to OECD-CRS). Of this amount, US\$ 3.9 billion was in the form of grants, whereas US\$ 3.5 billion was in the form of concessional loans.

Inter-American Development Bank (IDB) Water and Sanitation Initiative

For many years, development banks financed institutional reforms in the region rather than infrastructure investment, however the situation is now changing. In 2007, IDB launched the Water and Sanitation Initiative, aimed at providing a new set of tools and flexible financing for countries in Latin America and the Caribbean. Between 2007 and 2011, the initiative will emphasize four programmes:

- 1) *100 cities programme* – designed to catalyse investment financing and technical assistance for Latin American and Caribbean cities of more than 50 000 people, giving priority to their poorest communities;
- 2) *Water for 3000 rural communities* – to support communities willing to make their own financial, technical and organizational decisions and to run their local water and sanitation systems;
- 3) *Water defenders* – to provide technical assistance and financing to safeguard 20 priority micro-watersheds;
- 4) *Efficient and transparent utilities* – to finance programmes to strengthen the management of water utilities and to develop a system to measure and certify their performance.

Source: IDB (2007).

Challenges to LAC for reaching the MDGs

The main challenges facing the region that need to be overcome if the drinking water and sanitation MDG target is to be reached can be summarized as follows:

Sanitation target

The achievement of the sanitation target is a key challenge facing Latin America and the Caribbean. Whilst Paraguay (from 37% to 70%) and Honduras (44% to





Fig. 8. Peru water treatment plant. Source: WHO.

71%) are examples of countries that have made significant progress in increasing access since 1990, Haiti is experiencing problems in increasing coverage from a very low baseline and, whilst access has increased from 19%, in Bolivia use of improved facilities is still only 25%. Hygiene promotion is being addressed through the implementation of national scale communication programs for hand washing in partnership with the governments and the private sector, for instance in Peru.

Vulnerability and inequality

The LAC region is said to be one of the most unequal regions in the world. There are strong disparities between access to water and sanitation in the countries within the region and within the countries themselves. There are countries with 100% or nearly 100% coverage, such as Barbados as well as countries that are far from reaching acceptable coverage levels, such as Bolivia, Haiti and Nicaragua among others. Attention should be paid to those countries lagging behind in meeting the MDG target. Within countries, there are also disparities in access to water and sanitation between different cities, provinces, states, regions and municipalities and for the most vulnerable groups, which is directly linked to the higher levels of poverty e.g. indigenous peoples, Afro-descendants, women living in poverty and informal settlements). It is estimated that 70% of persons without access to drinking water and 84% of those lacking sanitation services are in the bottom two income quintiles (Inter-American Development Bank, 2007, quoted in Fernández, 2009). For instance in Paraguay the indigenous population (1.7% of the total population) has significantly reduced service levels (e.g. 37% of the indigenous population is collecting water from open ponds [Goal WaSH, UNDP 2009]). One example of a programme that specifically aims to reduce poverty through improved access to drinking water services is the Water for All Programme (PAPT) in Peru.



Fig. 9. Nicaragua hand pump. Source: WHO.

Urbanization

Rapid urbanisation is taking place in the LAC region with an estimated 75% of the population living in an urban area. Urban-rural disparities are particularly visible with respect to access to safe water and basic sanitation in Latin America, with urban coverage at 86% against rural coverage of 55%. While 93% of the urban population with access to an improved source of drinking water has a household connection, in rural areas this applies to 63% of the population.² Of almost 1.8 billion people gaining access to improved drinking-water in the period 1990-2008, 59% live in urban areas. The rural population without access to an improved drinking-water source is over five times greater than that in urban areas. Sanitation coverage is significantly larger for the urban population than for those living in rural areas.

Service quality

Service quality differs between countries and between cities in LAC: even those countries on track to achieve the MDG targets – such as Honduras - face tremendous challenges in improving service quality, in the form of continuity of supply, pressure, safe drinking water quality, and wastewater treatment. Greater commitment to capital maintenance costs is required otherwise those who currently have access to adequate levels of service will fall back to being unserved.

What more will it take to bring countries on-track?

Additional activities are required to improve the way in which funds for the sector are used: the majority of off-track countries in meeting the sanitation or water MDG target do not have viable sector programs while having weak capacity to deliver water and sanitation services at scale. A number of key areas of concern are outlined below, reference is made to the findings in the UN-Water GLAAS 2010 report from Bolivia, Honduras and Paraguay.

Political base

Despite the pivotal role of sanitation and water supply in meeting all of the MDGs, the sector remains a low priority on many national agendas – even though many countries in the region have declared access to water a human right.³ Prioritising WASH in budgets facilitates sector visibility in the national budget process – yet Paraguay and Bolivia stated that less than 50% of funds for water and sanitation were on budget. Sanitation in particular suffers from low political prioritisation: about 115 million of the region's people are not using an improved sanitation facility, which is fundamental for human health and dignity. Having specific and trackable budget lines for sanitation and hygiene makes it easier to track expenditures and monitor outcomes. Political will is also required to implement key national commitments including those commitments made at the LatinoSan Conference (the Cali Declaration, 2007;⁴ Foz do Iguacu, 2010) and other regional sanitation and water meetings.

National planning frameworks

Establishing a sector policy, national sanitation and water plans, legal and accountability framework and regulatory regime are all critical to achieving effective financing for the water and sanitation sector in the medium and long-term. In their returns to the UN-Water GLAAS report, although Honduras stated there was no policy for drinking water (urban and rural) and the policy for urban sanitation was not yet agreed – it indicated positive trends in policy development; Paraguay reported policies for water and sanitation (urban and rural) but that these hadn't been agreed by stakeholders or approved by cabinet. The lack of a national water and sanitation policy in Paraguay is said to be hindering the rate of investment (WASH

News 2010). Bolivia reported that over the last 3 years the adoption and implementation of effective sector policies, regulations and reforms is getting better for both drinking water and sanitation.

Targeting resources

A high proportion of aid for sanitation and water is not targeted towards basic services for the poor: (see Table 3). Funding tends to go towards large infrastructure projects (such as sewerage systems, wastewater treatment plants, and fecal sludge treatment plants), rather than to smaller-scale, low-cost technologies; sanitation; rural areas and subsidies for the low income groups where coverage gaps are considerable, as in Chile and Colombia, that are important, to help the poor pay cost recovery tariffs.

Data indicate that large disparities exist in the LAC region in urban/rural coverage and in drinking-water/sanitation financing – this may be because funding is not allocated equitably to and within urban/rural communities for sanitation and drinking-water. Both Paraguay and Honduras reported that equitability criteria have been developed and were being applied for specific drinking water projects but stated that there was no criteria applied for the rural sanitation projects. Whereas Bolivia reported that equitability criteria have been developed and applied to ensure funding is allocated to rural communities and that urban utilities have plans that are developed and implemented to serve the urban poor.

As a region, more needs to be done to improve targeting of resources to sanitation and hygiene, including specific budget lines and tracking/disclosure of these allocations, especially considering that hygiene promotion is considered the most cost-effective health intervention at US\$3.35 per Disability Adjusted Life Year or DALY

Table 3

**Trends in funding for water and sanitation in South America and North and Central America
(constant prices US\$ million 2007)**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
14020 Water and sanitation large systems														
South America	194.19	366.95	161.73	26.52	215.76	168.25	21.25	18.25	41.32	267.79	32.23	96.84	33.79	168.84
North and Central America	157.82	75.87	462.83	138.08	152.12	184.92	39.02	45.67	84.72	24.26	104.45	205.95	281.8	117.91
14030 Basic drinking water supply and sanitation														
South America	38.27	5.67	43.24	16.49	27.9	369.88	15.36	91.68	24.94	9.67	43.69	67.22	35.32	18.98
North and Central America	21.03	0.64	11.34	47.39	85.74	265.48	56.79	39.43	59.81	24.12	27.46	115.49	50.8	77.18

Source: <http://stats.oecd.org/Index.aspx?DataSetCode=CRS_SMPL> (last accessed: 14 July 2010).



averted (DPC, 2006)⁵ Good regional examples include the Peru Public Private Partnership for Handwashing with Soap campaign. For instance in Chile targeted subsidies mean that about 18% of low income clients receive subsidy of up to 85% (100% for extremely poor) of their monthly bill with consumption of up to 15 cubic meters.

In addition, much greater attention should be given to sustainability with respect to operation and maintenance. For instance Bolivia, one of the poorest countries of the region, reported issues with supply chains and the inability of user fees to cover operation and maintenance costs for rural supplies.

Capacity building

There is the need to develop the capacity to absorb an increase in sector funding: unlike Honduras, Paraguay has not fully addressed human resources in national plans or annual reviews of drinking-water and sanitation. This is interesting since there are in-country education and training institutions for drinking water and sanitation professionals in Paraguay – although these opportunities have been declining in recent years. Yet in Honduras it was reported that there are no opportunities for training and education existing in-country with no prospect for improvement. For Bolivia, it seems that there are in-country education and training institutions for sector professionals and that there are teaching skills that match the need for service delivery. It is particularly interesting to note for Bolivia that the adequacy of the small-scale local private sector has been declining in the last 3 years. However, it seems for these respondents that the human resource availability for the sanitation and hygiene sector is less than for drinking water sector.

Government rates of absorption of donor commitments are affected by a number of factors. These range from the quality and efficiency of country or donor procurement systems to the availability of equipment and skilled human resources to local conditions. Paraguay indicated that they used over 50% of official donor commitments across both sanitation and drinking-water, both urban and rural. Honduras reported that over 75% of donor comments are utilised.

Mutual accountability

As well as increased political commitment, mutual accountability in partnerships and agreements – through better targeting of aid, improved aid harmonization and alignment; and increased national budgets for water supply and sanitation – is required to ensure sustained access to sanitation and drinking water. For example, the *Sanitation and Water for All* initiative is a newly launched mechanism through which global aid to the water and

sanitation sector could be better aligned behind government policies and programmes⁶ which aligns well with the increasing efforts that during the past decade donors have placed on improving the effectiveness in the way aid is delivered (e.g. 2005 Paris Declaration on Aid Effectiveness, 2009 Accra Agenda for Action).

Conclusion

This article has outlined the challenges to LAC for reaching the MDG water and sanitation target, especially with respect to the hard-to-reach or neglected unserved populations.

Based on the findings of the UN-Water GLAAS 2010 report, it is argued that among the many impediments to achieving the internationally agreed target on water and sanitation are the political commitment and priority that governments attach to the sector, particularly in terms of budget allocation and financing of services, the lack of capacity in some countries, and the need to ensure better targeting of resources to the un-served (particularly to rural areas and low-income groups). Other challenges for the attainment of the targets relating to drinking water and sanitation are to improve service quality in respect of issues such as continuity and drinking-water quality and to expand the treatment of urban sewage. With respect to the literature and the UN-Water GLAAS 2010 report, it was acknowledged that, on a regional basis, greater attention is required to improving the balance of spend between water and sanitation and between urban and rural investment. At the national level financing safe water and basic sanitation requires prioritizing access to basic water and sanitation services, building viable sector programs and planning frameworks (that government and development partners can fund), the creation of an effective subsidy system for the poor as well as building capacity necessary for extending access on a sustainable and equitable basis necessary to achieve sanitation and water for all.

UN-Water GLAAS has a potential role in supporting sector monitoring and for strengthening the accuracy and depth of regional sector knowledge. Currently Bolivia, Honduras and Paraguay are participating in the UN-Water GLAAS reporting and other LAC countries have started the process to participate. The LAC region holds many lessons now for all countries pursuing the MDGs and, especially, for the post-2015 scenario towards universal coverage for all populations. □

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Notes

1. In Latin America, under 5 mortality rate for 2008 was 23 per 1,000 live births.
2. Although this number is high as compared to global level of 34%.
3. The Honduran general water law declares access to water a human right. The domestic laws of Honduras include individual rights to access to sanitation. The complementarity of water supply and sanitation is recognized in Paraguay's General law governing the regulatory and tariff framework for the public drinking water and sanitation services for the Republic of Paraguay.
4. The Principles of which were: to prioritize sanitation in the national development policies; to support the achievement of the main objectives of the International Year of Sanitation; and to strengthen the intergovernmental cooperation in the Region.
5. One DALY can be thought of as one lost year of 'healthy' life and the burden of disease as a measurement of the gap between current health status and an ideal situation where everyone lives into old age free of disease and disability.
6. <<http://www.sanitationandwaterforall.org/>>.

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Best practices in transboundary water management

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KEYWORDS

CONFLICT
COOPERATION BUILDING
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LEGAL FRAMEWORKS
RIVER BASINS
SUSTAINABLE DEVELOPMENT
TRACK II INITIATIVES
TRANSBOUNDARY
UNITED NATIONS
WATER MANAGEMENT

Achieving water security through transboundary water management

Water is a fundamental need for life and development. States work to ensure that their citizens have access to the required amount of water to live a decent, long and fulfilled life. A long list of uses are associated with water, and the challenge of providing for them is further complicated when water resources are shared by two or more countries. The simple fact that not only water, but also water pollution crosses borders shows how poor cooperation can adversely impact water security in the case of transboundary waters. Water insecurity could be defined as ‘a lack of capacity to deliver the expected outcomes from investment and management in water resources for socially inclusive, environmentally sustainable economic development’¹. Being needed for all aspects of life, access to water is, in fact, a prerequisite for the realization of a long list of human rights.

The challenge of achieving water security through cooperation and peaceful development of transboundary water resources is all the more important as transboundary water bodies account for a significant part of total water resources worldwide. As well as the 276 transboundary river basins that cover about 45% of the Earth’s land surface (see, for example, De Stefano et al, 2009), an estimated 274 aquifers cross the borders of two or more countries (Puri and Aureli, 2009). These water bodies are essential to the life of over 3 billion people, not to mention the fact that up to 90% of the world’s population lives in countries that have at least one transboundary water body. These figures leave no doubt: management of transboundary waters is an essential part of global water security and it is crucial to adopt, support and spread best practices in this area.

Most of the countries that share their water resources are likely to face the same challenges: scarcity, sharing, maldistribution, over-utilization and misuse of water (Kliot, Shmueli and Shamir, 2001). Scarcity depends on geographic and climatic conditions, but also on pollution and water demand. Today, 884 million people do not have an improved source of drinking water (WHO/UNICEF, 2010). Maldistribution is conditioned by geography and climatic fluctuations. A basin where resources are generally abundant is not necessarily a basin in which everyone has the same access to water. The issue of sharing is a problem when there is no framework defining clear rules of sharing. Over-utilization and misuse are also crucial issues, as their impact is potentially adverse for all involved, including the riparian countries.

These pressure factors do not have the same impact everywhere, but changing contexts exacerbate already difficult situations. Population growth and movements mathematically increase demand for a scarce but essential resource. Food demand follows the same trends, while changes in consumer preferences and consumption patterns towards more water-intensive products such as meat amplify the pressure on water withdrawals. Not to mention that dangerous and adverse effects of climate change threaten water and other natural resources.

Nevertheless, water differs from other natural resources by the myriad of uses it provides for. Domestic consumption, agriculture and industry are the three main sectors that rely on secure and sustainable freshwater resources. Water is therefore at the heart of economic and human development and yet the increasing competition between these various uses is degrading the ecosystems on which they depend. The challenge is now to

meet all these competing and often complementary needs, through equitable and sustainable means which do not threaten ecosystems.

Hence, water resources management is necessarily conflict management. Transboundary water bodies have long been subject to rivalries. 'Rival' and 'river' have the same Latin root, both are derived from *rivus* or 'stream'. Not surprisingly, the world's oldest existing international organization, the Central Commission for Navigation on the Rhine, est. 1815, was established to manage a transboundary river. The dramatic increase in the number of river basin organizations (RBOs) and treaties is another sign of the importance given to cooperation in transboundary basins.

However, and despite obvious progress, international law in this area remains embryonic. The 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses is one of the noteworthy efforts made towards an enhanced legal framework on transboundary waters protection, preservation and management. Three articles of the Convention are of significant importance. Article 5 affirms the concept of 'Equitable and reasonable utilization' of the resource. Article 7 affirms the 'Obligation not to cause significant harm'. Finally, Article 8 affirms the 'General obligation to cooperate'. It is thus one step further towards water security and cooperation. However, this Convention has not been ratified yet?

International law on transboundary surface waters progresses at a slow pace, as does international law on transboundary aquifers. In 2008, the UN General Assembly adopted a Resolution on the Law of Transboundary Aquifers (A/RES/63/124) which recommends that the states concerned 'make appropriate bilateral or regional arrangements for the proper management of their transboundary aquifers, taking into account the provisions of [the] draft articles' annexed to the resolution. These provisions include cooperation to prevent, reduce and control pollution?

Another longstanding example of progress in this context is the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UN ECE Water Convention). This focuses on the obligations of parties to protect their transboundary surface waters and groundwaters and manage them in a sound and ecological manner. The Convention creates obligations for its parties to prevent, control and reduce water pollution from point and non-point sources. It also provides for coordination and information among states sharing the same resource, and with the public. In 2003, the Water Convention was amended to allow accession by countries outside the UNECE region, thus inviting the rest of the world to use the Convention's legal framework and to benefit from its experience.

These efforts are proof that cooperation in transboundary water management is recognized as an important issue that requires clear and strong political will. Innovative policies must be implemented for all situations where stakeholders face difficulties cooperating over their shared water resources. This process cannot be successful without access to knowledge and information on best practices that have proven to be exemplary for the enhancement of peaceful and cooperative management of transboundary water bodies.

Lessons learned from international experiences of cooperation

Watercourses flow through complex ecosystems that constitute unique geographical and hydrological entities. Consequently, transboundary water management has a regional dimension that requires adopting integrated and systemic approaches. The river basin is therefore the most appropriate level for cooperation.

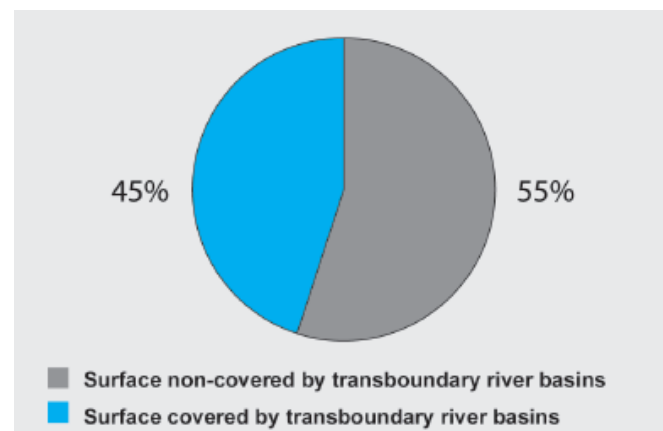


Fig. 1. Earth's land surface covered by transboundary river basins.



Fig. 2. Major river basins of the World.



Transboundary water resources management necessitates tailor-made initiatives that fit geographical, political and cultural specificities of each basin. Nevertheless, examples of successful policies and initiatives must be highlighted and spread out to influence or to be intelligently transposed.

**The Columbia river basin:
virtues of amiable relations
and strong legal/administrative frameworks**

The Columbia river basin, situated in the Pacific Northwest, is one of the most important river systems in North America. The Columbia river (2,000 kilometres) and its tributaries cross the boundaries separating Canada and the United States in a way that makes both states downstream and upstream riparian countries. The Columbia river basin is the most hydroelectrically developed river system in the world. Today, about 400 dams in the basin generate an average of 12,000 megawatts a year (Center For Columbia River History, 2010). This accounts for about 40 percent of the United States' hydroelectric power.

Challenges have always been numerous. The obvious demographic and economic asymmetry between the two states could have been an obstacle to the fair sharing of benefits arising from the development of the basin resources. Besides, it is crucial to take into account the existence of a dozen Amerindian reservations, whose socio-economic and cultural specificities depend on the maintenance of fishery resources and, more globally, on the preservation of the ecosystem. In this case it is the question of costs and benefits sharing that constitutes a challenge for peaceful and effective cooperation. The situation is particularly difficult in the Columbia river basin considering the important number of stakeholders. Two countries, seven US states, one Canadian province, several tribes and various local agencies are involved in the management of the water resources.

Fragmentation and the resulting competition has not prevented cooperation from prospering. Historical amiable relations between the two riparian states has greatly facilitated the process and proved that trust and mutual understanding are prerequisites for a shared vision of water resource management.

These good relations also facilitated the establishment of a permanent and comprehensive legal/administrative framework for planning and organization whose basis was the 1909 Boundary Waters Treaty. This led to establishment of the International Joint Commission (IJC), which settled numerous disputes regarding the use and quality of water on the international boundary. Eventually, the IJC convinced the riparian countries of the feasibility of international development of the Columbia river. The



Fig. 3. Glacier National Park, Montana, United States of America.
Source: UNESCO/B. Von Droste.

United States consequently accepted sharing the downstream benefits resulting from the development of the Columbia river and its tributaries.

The 1964 signing of the Columbia River Treaty (CRT) completed this cooperation effort by affirming the principle of equal sharing of downstream benefits for hydropower and flood control. According to Keith Muckleston (2003), adopting the principle of equality rather than equity provides more certainty and reduces subjectivity in negotiations over international waters use.

The two countries achieved their hydropower and flood control objectives through the implementation of sound and organized cooperation based on amiable relations and mutual trust. Of course, several issues still need to be addressed, and priority should be given to the introduction of greater flexibility in the existing legal and administrative framework. Despite its merits in providing permanent and solid mechanisms of cooperation, it fails in rapidly adapting to modern issues. Cooperation originally focused on economic development and especially hydropower production. The environmental cost is high: annual runs of salmon have declined from an estimated 8 to 16 million to an average of fewer than 1 million (*Water Encyclopedia*). Several species are now considered as threatened or endangered. Nevertheless, a recent shift in the cooperation paradigm from economic development to ecosystem management and restoration might help to re-establish the balance between costs and benefits.

**Reversing historic patterns: The Nile basin
slow progress towards cooperation**

The Nile flows from the Great Lakes in Central Africa to the Mediterranean Sea in Egypt. The 6,500 km covered by the watercourse make the Nile the longest river on

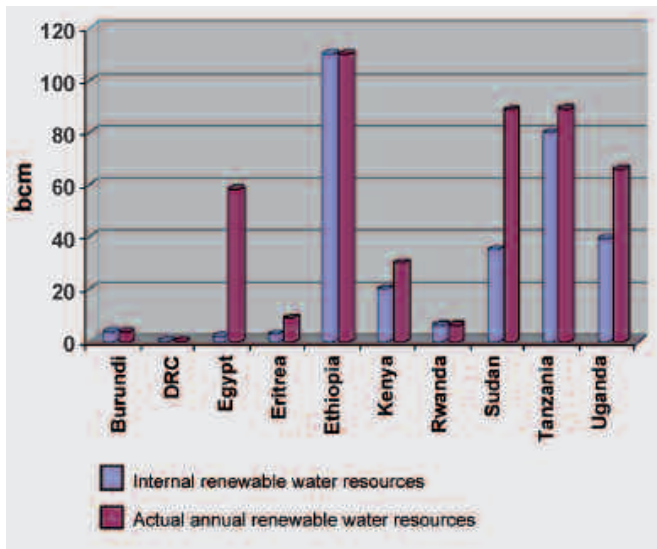


Fig. 4. Water resources in the Nile river basin riparian countries.
Source: Alan Nicol (2003).

Earth. Currently shared by ten countries,⁴ it provides water for some 150 million people living within its basin. Given its size, the Nile river basin is home to high ethnic, cultural and religious diversity. Additionally, the legacy of colonization is a mosaic of countries whose borders hardly reflect the basin's physical or human geography. Cooperation on its water resources management only started in the late 1980's when social, economic, and political changes took place at regional and global levels.

The media and some scholars often depict the Nile river basin as a 'hotspot' for future water wars. Indeed, increasing water demand in developing countries facing steady population growth puts high pressure on already scarce resources and could cause violent conflicts. According to the current trends, five to six of the ten riparian countries⁵ will be 'water scarce' (less than 1000 cubic meter per capita) by 2025 (Alan Nicol, 2003).

The riparian countries will certainly face difficulties in overcoming this threat. Many of them were or currently are involved in serious intra-state or international conflicts rooted in complex socio-ethnic divides. This lack of regional stability is a clear barrier to effective cooperation, and the great asymmetry existing between the countries is an additional challenge for equitable benefits sharing and common development. Egypt itself has a greater GDP than the nine other riparian countries added together (World Bank, 2008). The disparity in the levels of development among the countries contribute to differing needs and therefore different national objectives.

Another obstacle to the handling of the anticipated water crisis is the legacy of historic patterns of unilateralist usage of water resources. Downstream countries such as Sudan and especially Egypt are extremely dependent on external water resources⁶ and have been exploiting and

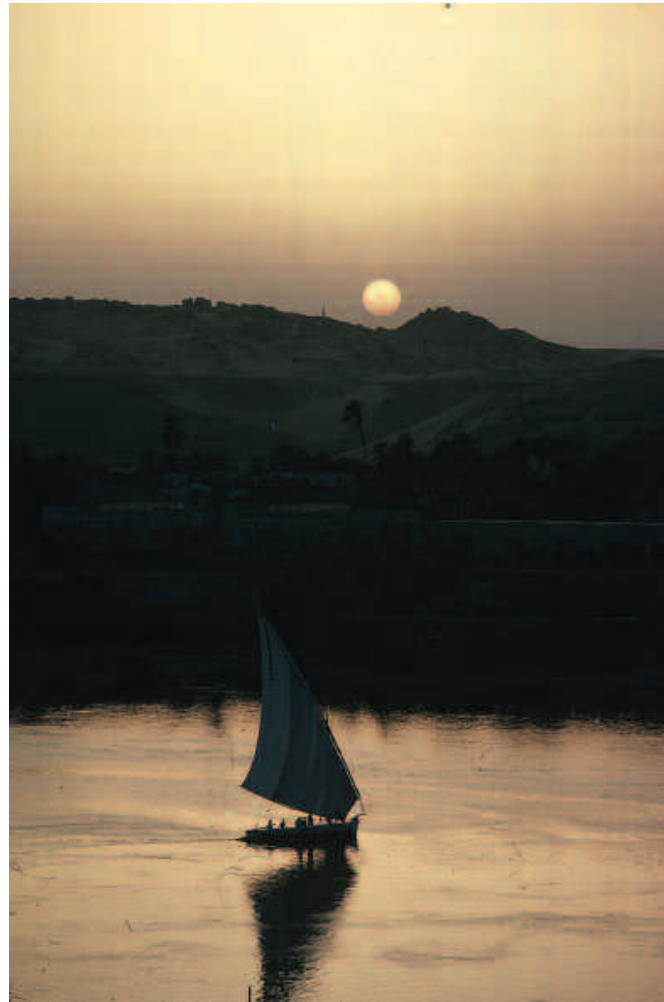


Fig. 5. The Nile river near Philae, Egypt.
Source: UNESCO/Dominique Roger.

capturing the river's flow for centuries, claiming historic or acquired rights to the water resources of the Nile.

In 1959, Egypt and Sudan signed the Nile Waters Agreement that divided all the Nile waters between them.⁷ This agreement, along with other attempts to control the Nile resources, contrasts with the growing needs of upstream developing countries which contest the legitimacy of such agreements and practices.

Despite all these obstacles, relations between the ten riparian countries have moved towards cooperation instead of conflict. The shift started about 20 years ago in series of forums and meetings which stressed the need for multi-sectoral thinking. As mentioned by Alan Nicol, these meeting were 'originally launched to provide an informal mechanism for riparian dialogue and the exchange of views between countries, as well as with the international community' (NBI, 2001), [but they] also enabled informal contact between officials of riparian states and with external 'facilitating' organizations.' (Alan Nicol, 2003). In 1992, the meeting of Nile Water Ministers resulted in the establishment of the Nile river basin Action Plan, which paved the way for the broader Nile Basin Initiative (NBI), a transitional riparian-led



process of joint decision making and cooperative development. Initiated by nine riparian countries (Eritrea is an observer) and the World Bank, it managed to foster a shared vision of the Nile 'to achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile basin water resources.' (Alan Nicol, 2003). The use of the word 'equitable' and the new concern in sharing benefits are concrete steps towards cooperation.

Another significant achievement of the NBI is the adoption of the principle of subsidiarity. The idea was to increase efficiency and cooperation by adapting projects to the ground realities and by reducing the decision-making complexity. The Nile river basin was then split into two sub-basins, comprising the countries of the 'Eastern Nile' and the countries of 'equatorial lakes'.

The political will to jointly address development challenges and assistance from the international community launched the institutionalization of cooperation. However, the current institutional framework is not strong enough to address the numerous challenges the region faces. The successes of the Nile cooperation will be judged on the capacity of riparian countries to create permanent institutions able to influence development and to achieve poverty reduction targets through concrete projects with equitable and mutual benefits. Such an objective must be reached at local, national and regional levels where integration is still weak and divides important.

Overcoming conflicts and development challenges: the successful example of the Mekong river basin

The Mekong river, the longest river in Southeast Asia, originates from the Tibetan Plateau in China and flows through the Yunnan province, Myanmar, Laos, Thailand,

Cambodia and Vietnam. 86 million people live within the basin, which shelters rich biodiversity and supplies water for one of the major agricultural areas in Asia. Subject of various studies, the Mekong river basin is usually regarded as the first successful example of cooperation on transboundary water resources in developing countries.

The contemporary Mekong River Commission is the outcome of over fifty years of slow, yet effective evolution of both institutions and principles of action. The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), conducted many studies⁸ on the expected benefits from the management of the Mekong resources through cooperation on planning and data collection. The Mekong Committee was thus created in 1957, under the aegis of UNESCAP, as an intergovernmental agency based on the principle of equality of rights and aimed to 'promote, coordinate, supervise, and control the planning and investigation of water resources development project in the lower Mekong basin' (article 4 of the 1957 statute).

The limited powers of the Committee progressively expanded until 1976-1977 and the political consequences of the Cold War and of the political turmoil in Cambodia, which no longer participated in the Committee's activities. The political changes of the late 1980's along with the increasing socio-economic divide between the countries offered new opportunities and challenges to the Lower Mekong countries. After four years of negotiations, Cambodia, Laos, Thailand and Vietnam signed the 'Agreement on the Cooperation for the Sustainable Development of the Mekong river basin', which established the Mekong River Commission (MRC). It benefited from a stronger structure composed of the Council, the Joint Committee and the MRC Secretariat, which is the operational arm of the organization. The shift in focus from planning towards implementation the contemporary MRC is based on an integrated basin development approach, which focuses on urgent national development issues and seeks to achieve the 'sustainable development, utilization, management, and conservation' (MRC, 1995).

Many reasons explain the success of the Mekong cooperation and should be highlighted here to serve as an example for developing countries in particular. The context was favorable as the four Southeast Asian countries had strong traditional and cultural similarities. In addition, the absence of conflicts and water crisis at the early stages of cooperation rooted the process in a shared vision for the benefits of all stakeholders rather than on difficulties to overcome. Cooperation was thus driven by a positive will to foster the promotion and coordination of integrated basin development through regional cooperation (Ti Le-Huu, 2003).

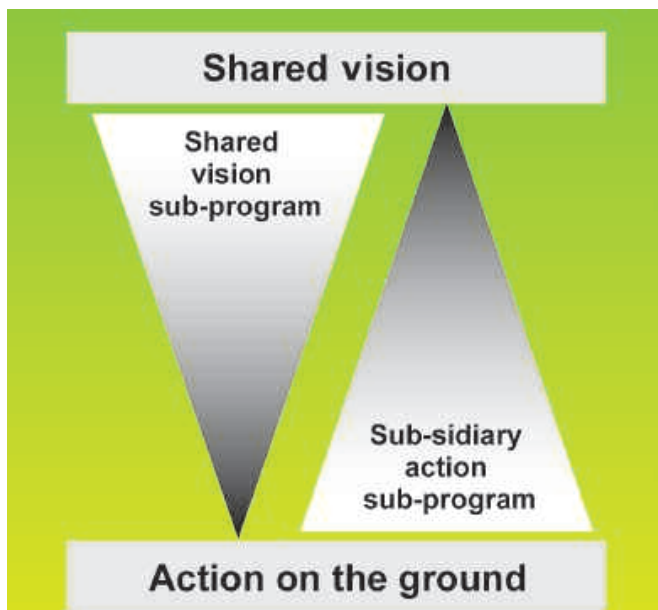


Fig. 6. Principle of subsidiarity. Source: Alan Nicol (2003).

The riparian countries always maintained a certain degree of flexibility, which, contrary to the Columbia river basin case, permitted them to adapt to the evolution of needs and contexts. The cooperation framework survived in the face of increasing asymmetry of development, the conflicts of the Cold War era and even the defection of Cambodia. Later, the riparian countries included the new concept of sustainable development and conservation in the cooperation framework.

However, flexibility did not prevent the adoption of rules. Two core principles supported cooperation: the existing low water discharge of the Mekong would not be reduced in any way at any site and the supplies to be diverted for irrigation purposes would be met by some storage of flow during high stages of the river. These two principles were included in the 1995 agreement with several important articles including Article 5 on reasonable and equitable utilization of water, Article 6 on maintenance of flows on the main stream, and Article 26 on rules for water utilization and inter-basin diversions.

The riparian countries also benefited from free exchange of information that facilitated mutual understanding. Technical and financial support became possible thanks to mutual trust. For instance, a dam built in Laos and funded by the riparian countries continuously supplied nearly 80 percent of its energy to Thailand despite recurrent tensions between the two countries.

The success of the Mekong basin cooperation has been widely recognized but the pursuit of effective cooperation depends on the political will of countries that also have to face internal instability and political battles. Both institutional capacity and transparency must be reinforced. Furthermore, the comprehensive sustainable management of the Mekong river basin will hardly be achieved without the involvement of the two upstream countries that are Myanmar and China.

The benefits of Track II initiatives for cooperation building

The three examples presented above show that the main obstacles to effective cooperation often originate from the lack of trust and perceived mutual interests at the top of the political sphere. Overcoming obstacles necessitates having a global understanding of the potential outcomes of cooperation at local, national and regional levels. Such a task can hardly be achieved without the involvement of many players with various visions and areas of expertise.

This is one reason why alternative solutions to traditional diplomacy have been implemented to foster cooperation on transboundary water management. Known as Track II initiatives, they consist of formal or informal interactions between public and/or private stakeholders from

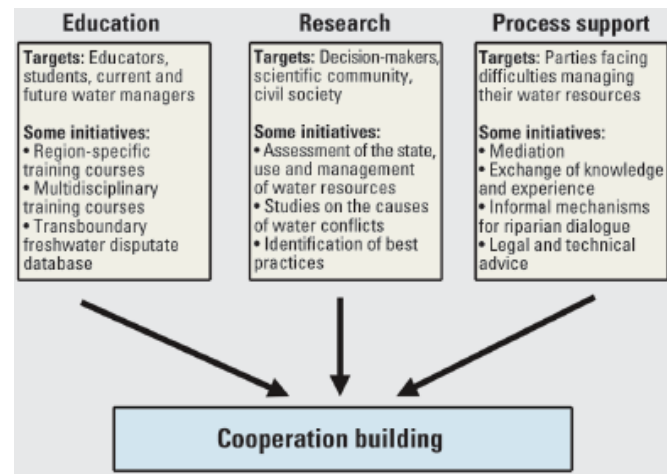


Fig. 7. Track II initiatives.

different groups and nations to facilitate discussions and exchanges in order to foster peace and cooperation. Track II initiatives are often based on three pillars: education and training, research and process support. In the context of transboundary water resources, education and training targets current and future managers of transboundary waters. Research focuses on the assessment of the state, use and management of water resources along with studies on the causes of water conflicts, and best practices. Finally, process support seeks to provide parties facing difficulties managing their transboundary water resources with international fora in which to establish dialogue and exchange knowledge and experience related to water management and security.

Because Track II initiatives require going beyond government to government interactions, international organizations have often played a major role in implementing and supporting these initiatives. For example, UNESCAP has played a major role in the Mekong, as has the World Bank in the Nile region. Given the duality of water, which is both a prerequisite for the realization of a long list of human rights and a conflictive resource, more and more organizations are developing series of tools and programmes to facilitate the peaceful management and sustainable development of transboundary water resources at local, national and regional levels.

The United Nations and its agencies are in a particularly good position to intervene. As neutral organizations, they benefit from technical and financial resources and are at the core of a wide network of individuals and institutions working in the same areas of expertise. Their strategic position as well as their long experience is therefore a valuable advantage to spread best practices in transboundary water resources management.

As a contribution to the work of UN-WWAP, UNESCO recently implemented a new process to enhance cooperation on transboundary water resources management





Fig. 8. Titicaca lake, Nacas, Bolivia. Source: UNESCO/Alberto Jonquières.

through case studies.⁹ The writing process relies on the commitment, in each country involved, of high-level players, governmental advisers and a host of experts and stakeholders who are invited to prepare a consensus document reflecting the status on conflict and/or cooperation in the selected water body. The objective of the reporting process is indeed to constitute a forum for the discussion of sensitive issues. It also supports the actual cooperation and the development of the shared resources. Finally, it offers an opportunity for the stakeholders to build a joint vision for the future joint management of their water resources. Two case studies that followed this new process are the lake Titicaca case study and the Mono river case study.

Lake Titicaca case study

Located in the south of Peru and north-west of Bolivia, the lake Titicaca basin is spread over an area of 56.270 km². Decades of cooperation and integration led, in 1993, to the creation of the Bi-national Autonomous Authority of Lake Titicaca (Autoridad Binacional del Lago Titicaca, ALT). In this context, it was considered appropriate to disseminate, through the lake Titicaca case study, the lessons learned from the joint management of the basin resources. Experts were selected in coordination with the Foreign Affairs Ministries of both countries to write this document.

The joint management of the lake Titicaca discouraged unilateral decision making, which could have generated conflicts between the two riparian countries. Of course, many improvements are necessary. Among the recommen-

dations, it is worth mentioning the need to continue integration and to create a broader and more efficient coordination between the ALT and the local institutions in order for them to participate more actively in the management of the lake Titicaca basin.

Mono river case study

The Mono river basin, with a 24.300 km² area, is shared between Benin and Togo. In 2008 a case study bi-national committee was created to participate in two workshops (in Benin and then Togo) in order to give guidance to experts for research and writing tasks. The committee aimed to gather key stakeholders from various backgrounds and therefore included representatives from the Ministries linked with water resource management and representatives of civil society, NGOs and the National Water Partnerships of both countries.

The findings of the case study concluded that if minimal conditions for 'good neighboring' are met, the two countries need to define formula for territorial cooperation between local authorities. Therefore, it seems necessary to implement an institutional framework to organize cooperation between the two riparian countries for a sustainable and peaceful joint management of their water resources. The Track II process that led to the achievement of the case study is a first in this direction.

The Mono river and lake Titicaca case studies gave the states involved an opportunity to assess their accomplishments and expected progress. Track II initiatives, by in-

volving different but complementary players in society, disseminate best practices and eventually facilitate cooperation and prevent conflicts related to the management of transboundary water resources.

Conclusion

Experience and history show that cooperation between riparian nations continues to far outweigh conflict (de Stefano et al, 2009). This is now the case even in the contentious Middle East and Northern Africa region. According to the findings of the UN World Water Development Report, increased hazards and global changes 'in transboundary water resources (through engineered developments or climate change) will present opportunities for international cooperation.' (WWAP, 2009) Indeed, the examples presented in this paper show, in their diversity, that difficulties and challenges arising from conflictive relations, underdevelopment, socio-economic and political differences should not be seen as insurmountable obstacles. They certainly slow down the move towards cooperation and influence its pattern of development but past experiences have showed that good practices can overcome these difficulties. We have highlighted some of them, such as the recourse to international organizations, the con-

struction of a shared vision, solid and flexible legal and institutional frameworks, subsidiarity, political will and amiable relations, mutual trust or benefit sharing.

More importantly, these experiences prove to be resilient. Once riparian countries initiate the process of cooperation, it takes root. Despite divides, conflicts, delays and even backward steps, it never really stops. And so does institutionalization. This phenomenon should be seen as an encouragement for every attempt to foster cooperation in regions where water resources cross borders.

In the context of a changing world and a varying climate, possible impacts on water resources will call for a shift in cooperation paradigm towards greater regular and structured joint management of the resource. In actuality, this will create bigger and more frequent opportunities for international cooperation. Through joint management, benefits derived from water resources can be identified to allow the enlargement of the entities to be shared and the development of mutually accepted options for the long term and sustainable use of the resource. □

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Notes

1. Definition proposed by UN-ESCAP, IUCN and UNEP during the Brainstorming Meeting on IWRM, MDGs, and Water Security for the preparation of the State of the Environment in Asia and the Pacific Report 2010 (Bangkok, Thailand, 23 – 24 July 2009).
2. As of April 2010, resolution A/RES/63/124 has not been ratified by enough states yet to be in effect. The Convention will enter into force on the ninetieth day following the date of deposit of the 35th instrument of ratification, acceptance, approval or accession with the Secretary-General of the United Nations.
3. The articles were prepared by the International Law Commission (UN-ILC) with the technical and scientific support of UNESCO's International Hydrological Programme (IHP).
4. Rwanda, Burundi, Democratic Republic of the Congo (DRC), Tanzania, Kenya, Uganda, Ethiopia, Sudan and Egypt.
5. Burundi, Rwanda, Egypt, Ethiopia, Kenya and possibly Tanzania.
6. For instance, the dependency ratio in Egypt was 97% in 2008 (FAO, 2008).
7. Calculated on the basis of an assumed annual average discharge as measured at Aswan (south of Egypt) of 84 billion cubic meters (55.5 bcm to Egypt and 18.5 bcm to Sudan). 10 bcm were expected to evaporate annually after the formation of the lake Nasser.
8. The results were compiled in the 1956 report 'Development of Water Resources in the Lower Mekong Basin'.
9. For more details, visit the website of the UNESCO programme 'from Potential Conflict to Cooperation Potential': <<http://www.unesco.org/water/wwap/pccp/>>.

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UN-Water Thematic Priority Area on Water and Climate Change: Background, goals and achievements

Claudio Caponi

KEYWORDS

CLIMATE CHANGE
CLIMATE VARIABILITY
ADAPTATION TO CLIMATE CHANGE
UN-WATER
WATER RESOURCES MANAGEMENT

Background

Water is the link between climate, human society and ecosystems. The impacts of climate change on economy, human health, hunger and diseases frequently touch human livelihoods through disruptions in the water cycle; affecting the availability of fresh water (both quantity and quality), the frequency of floods and droughts and changes in seasonality. The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) indicated that billions of people, particularly in developing countries, might face shortages of water as a result of climate change.

Many of the UN agencies have prepared or are preparing their responses to the unequivocal predictions of the IPCC. Under the United Nations Framework Convention on Climate Change (UNFCCC) process, the Nairobi Work Programme on impacts, vulnerability and adaptation to climate change highlights the need for comprehensive and cross-sectoral adaptation planning, as changes in water resources also affect other sectors such as agriculture, health, energy and infrastructure.

UN-Water was established in 2003 as an inter-agency mechanism to strengthen collaboration on water-related issues within the UN system and with non-UN partners.

As such, it seems only reasonable that it should play an instrumental role in advancing the comprehensive and cross-sectoral adaptation planning process between agencies. A more coordinated UN system could play a proactive role at the global level right down to coordination of specific support activities provided to countries facing the challenges of climate change and impacts on their water resources.

The bulk of UN-Water activities are carried out through time-bound Task Forces (e.g. Gender and Water; Indicators, Monitoring and Reporting; Country-level Coordination; Sanitation) established to focus on specific areas of interest or emerging issues, as well as through Thematic Priority Areas (Climate Change; Transboundary Waters), which are not time-bound. UN-Water also has four specific programmes, namely the World Water Assessment Programme (WWAP), the WHO / UNICEF Joint Monitoring Programme on Water Supply and Sanitation (JMP), the UN-Water Decade Programme on Capacity Development (UNW-DPC) and the UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC). Each of these Programmes has its own work plan, budget and executing agency coordinating implementation.



Fig. 1. Aerial view of melting glaciers in Antarctica.
Source: UN Photo/Eskinder Debebe.



Fig. 2. Drought in Africa.
Source: UN Photo/E. Darroch.

The establishment of a UN-Water Task Force on Water and Climate Change was proposed in 2008 aiming to offer “an opportunity to further discuss climate change and water linkages in their widest sense and to ensure that the UN-System in general, and UN-Water in particular, is better prepared to meet further challenges and play an essential role in this area. A Task Force could also serve the function of further elaboration on how the UN System, through increased interaction and coherence by strengthening a mechanism such as the UN-Water, could play a more proactive and constructive role in the formulation and implementation of relevant adaptation and mitigation strategies”.

Its first round of activities completed by 2009, such as the coordination of preparatory activities of UN-Water members and their contribution to the outcomes of the 5th World Water Forum, the World Climate Conference-3 and COP15, the preparation of a one-page UN-Water statement on water and climate change, and the initiation of a mapping and gaps analysis exercise with the ultimate goal of producing guidelines for UN-Water members addressing the key challenges and water-related adaptation/mitigation issues, brought to evidence that the idea of establishing a coordination mechanism to address the issues related to water and climate change was indeed filling in a gap.

On the other hand, it has also become clear that climate change issues will continue to be at the forefront of UN-Water concerns for several years, if not decades, and that in order to respond to the challenges they pose, a long-standing coordination mechanism would be more adequate than the one initially proposed. Hence, as per the decision of the UN-Water meeting in January 2010, the Task Force on Water and Climate Change was transformed into the *Water and Climate Change Thematic Priority Area (WCC-TPA)*. A more thorough description of the above mentioned outcomes and activities is available in the sections below.

Objectives of the WCC-TPA

The core objective of the WCC-TPA is to strengthen UN System coordination on activities related to water and climate change in order to facilitate assessments by Member countries of the impacts of climate change on water and adoption (by these) of strategies for meeting the challenges of climate change both for adaptation and mitigation in the related water sub-sectors.

The Work Plan of the WCC-TPA for its first two years of existence (2009-2010) included both short-term (four) and long-term (four) activities which are outlined below.

Short-term:

1. To foster cooperation and coordination in preparatory activities and at the 5th World Water Forum in March 2009 in sessions, the political track and in side events.
2. To contribute to the outcomes of the World Climate Conference-3 in August-September 2009.
3. To conduct a mapping exercise of UN-Water members and partners on mandates and capacities related to water and climate issues.
4. To assess capacity gaps within UN-Water and produce guidelines for members addressing the key challenges and water-related adaptation/mitigation issues.

Long-term:

1. To investigate opportunities to support the COP process (UNFCCC) in relation to water and climate change.
2. To develop a joint program on climate change mitigation and adaptation in water sector, with a joint pilot project in one of the identified countries under the one-UN, in collaboration with the UN-Water Task Force on Country Level Coordination.
3. To build awareness at various levels on climate change issues in various water related sectors.





Fig. 3. Only one Earth - The environment.
Source: UN Photo/Michos Tzovaras.

4. To develop relevant joint publications to serve the above purposes.

The following section will attempt to describe the activities the WCC-TPA has undertaken since its establishment.

Consensus building

The twenty eight members and twenty four partners of UN-Water all deal with water in accordance to their own mandate and expertise. A unique, powerful and pointed voice stems from UN-Water through its wide spectrum of member agencies, as all outcomes, statements and decisions are built on consensus and therewith provide robust decisions backed by all parties involved.

One example of such a document having gone through the intensive and inclusive development process to reflect the consensus of members and partners is the climate change adaptation UN-Water policy brief titled "Climate Change Adaptation: The Pivotal Role of Water". The Policy Brief states that water is the primary medium through which climate change influences Earth's ecosystem and thus the livelihood and well-being of societies. Higher temperatures and changes in extreme

weather conditions are projected to affect availability and distribution of rainfall, snowmelt, river flows and groundwater, and further deteriorate water quality. The poor, who are the most vulnerable, are likely to be the most adversely affected.

Water stress is already high, particularly in many developing countries; improved management is critical to ensure sustainable development. Water resources management affects almost all aspects of the economy, in particular health, food production and security; domestic water supply and sanitation; energy and industry; and environmental sustainability. If addressed inadequately, management of water resources will jeopardize progress on poverty reduction targets and sustainable development in all economic, social and environmental dimensions.

Adaptation to climate change is closely linked to water and its role in sustainable development. To recognize this reality and to respond accordingly presents development opportunities. Various necessary adaptation measures that deal with climate variability and build upon existing land and water management practices have the potential to create resilience to climate change and to enhance water security and thus directly contribute to development. Innovative technological practices and implementation of strategies are also needed at the appropriate levels for adaptation as well as for mitigation.

Adaptation to climate change is urgent. Water plays a pivotal role in it, but the political world has yet to recognize this notion. As a consequence, adaptation measures in water management are often underrepresented in national plans or in international investment portfolios. Therefore, significant investments and policy shifts are needed. These should be guided by the following principles:

- Mainstream adaptations within the broader development context.
- Strengthen governance and improve water management.
- Improve and share knowledge and information on climate and adaptation measures, and invest in data collection.
- Build long-term resilience through stronger institutions, and invest in infrastructure and in well-functioning ecosystems.
- Invest in cost-effective and adaptive water management as well as technology transfer.
- Leverage additional funds through both increased national budgetary allocations and innovative funding mechanisms for adaptation in water management.

Application of these principles would require joint efforts and local-to-global collaboration among sectoral, multisectoral as well as multidisciplinary institutions.



Fig. 4. MINUSTAH (UN Stabilization Mission in Haiti) military personnel assists hurricane victims.
Source: UN Photo/Marco Dormino.

Responding to the challenges of climate change impacts on water resources requires adaptation strategies at the local, regional, national and global levels. Countries are being urged to improve and consolidate their water resources management systems and to identify and implement “no regrets” strategies, which have positive development outcomes that are resilient to climate change.

It should not go unnoticed that the Policy Brief is not just one more document among several recently issued on related topics. It is the first example of a policy statement on water and adaptation to climate change having been developed in a collaborative way, and agreed upon by all UN-agencies and the most relevant non-UN organizations involved in the water issue. As such, it contains input and views from numerous sectors (e.g. drinking water supply and sanitation; agriculture; water and health; ecosystems; water-related hazards) and provides a complete information with an agreed-upon balance among the various perspectives. The views and messages of these different sectors are described below.

The Policy Brief also states that thus far, policy response to climate change has been dominated by the need for mitigation. Although these measures can slow down climate change, they will not halt or reverse it. Because the effects

of climate change are inevitable in the short and medium term, adaptation needs to be addressed with the same urgency as mitigation. Adaptation, as integrated into the Nairobi Work Programme of the United Nations Framework Convention on Climate Change (UNFCCC), relies on better understanding of the effects of climate change and on making informed decisions on how to cope with it. Water management, based on integrated and systemwide approaches, is the key to climate change adaptation.

Adaptation planning and practices need to be comprehensive and flexible. When developing cross-sectoral national climate change adaptation plans, proper attention should be given to water management. At the same time, adaptation requirements have to be considered in the climate risk management framework to ensure sustainable interventions. Water-related disaster risk reduction (DRR) and its strategies should be considered as tools in climate change adaptation, with greater integration of water-related adaptation.

Long-term, sustainable adaptation to climate change will require the integration of infrastructure, policy and economic instruments, as well as behavioural changes into national development strategies. Adaptation programmes should consider structural and non-structural measures as well as the potential offered by natural and





Fig. 5. Mud houses surrounded by floodwaters.
Source: UN Photo/Tim McKulka.



Fig. 6. UN Secretary-General extracts ice in polar ice rim.
Source: UN Photo/Mark Garten.

physical infrastructure and “soft” programmes that comprise incentives and sanctions. These measures should also be evaluated from the mitigation perspective. Efforts must be made to evaluate adaptation strategies for their likely impact on the ecosystem and on human health. Adaptation measures should be built on learning-by-doing principles, particularly those being introduced locally, which draw upon traditional and indigenous know-how that could enrich and widen scientific knowledge.

Adaptation measures can be categorized in the following five ways, which water managers have of adapting to contemporary climate variability and that could ultimately serve as the foundation for adapting to climate change:

1. Planning and applying new investments (for example, reservoirs, irrigation systems, capacity expansions, levees, water supply, wastewater treatments, ecosystem restoration).
2. Adjusting operation, monitoring and regulation practices of existing systems to accommodate new uses or conditions (for example, ecology, pollution control, climate change, population growth).
3. Working on maintenance, major rehabilitation and re-engineering of existing systems (for example, dams, barrages, irrigation systems, canals, pumps, rivers, wetlands).
4. Making modifications to processes and demands for existing systems and water users (for example, rainwater harvesting, water conservation, pricing, regulation, legislation, basin planning, funding for ecosystem services, stakeholder participation, consumer education and awareness).
5. Introducing new efficient technologies (for example, desalination, biotechnology, drip irrigation, wastewater reuse, recycling, solar panels).

Uncertainty should not be a reason for inaction. Adaptive management overcomes the challenges presented by uncertainties in various inputs to water management de-

cision-making, including long-term climate projections. Adaptive management allows for adjustments, as additional and better information becomes available. For infrastructure, a pragmatic and “proactive adaptive management” approach – similar to the “no regrets” philosophy of climate change adaptation – should be based on the development of a new generation of risk-based design standards that take into account climate uncertainties. Many non-structural measures are flexible and therefore more suitable for adapting to greater uncertainty in both the supply and demand side, and should thus be integrated into every adaptation strategy. Adaptive management requires continuous feedback and adjustments based on the information provided by monitoring networks.

With regards to managing increasing variability, greater climatic variability and short-term uncertainty is likely to be superimposed on any long-term trend, thereby increasing the frequency of extreme events. This variability calls for comprehensive risk management planning, including disaster risk reduction at various levels and adopting new technologies to develop improved early warning systems for better reservoir and emergency operations. Water operators will need to consider climate change predictions and uncertainties, and prepare for the risks of more intense droughts and floods. Likewise, communities will need contingency plans for rapid and coordinated responses to these phenomena. Demand management in the major user sectors can also improve resilience.

Creating the infrastructure for water resources development and distribution has shown high human and macroeconomic benefits; conversely, countries lacking this capability have suffered damaging shocks from droughts and floods. More water storage is required to manage increased variability of water resources. Some storage can be natural – enhancing groundwater recharge through rainwater harvesting, sustainably managing aquifers and nourishing wetlands. Other methods of stor-

age, such as small, medium or large reservoirs, can be constructed subject to safeguards for the environment and for communities. Both kinds of storage will be required in many regions to guard against droughts and floods and to provide regular multi-purpose benefits.

When it comes to drinking water supply and sanitation, the world is on track in meeting the Millennium Development Goal (MDG) targets for drinking water, but not for sanitation. At the moment, water is increasingly under strain from competing demands and climate change, affecting both quality and quantity. Adaptation calls for coherent measures to address water security for all major users with priority given to the basic needs of human hygiene, consumption and subsistence, which are defined as a basic human right. Increasing population and migration, and rising living standards will increase the demand for water services. The existing water supply and sanitation infrastructure was previously designed for different resource availability and water use. Such historical infrastructure will likely come under greater pressure owing to hydraulic changes and warmer temperatures. To upgrade or expand the availability of water supply and sanitation infrastructure is an urgent concern that will facilitate adaptation to climate change. Stormwater and wastewater infrastructures will have to include provisions for climate change effects in their design; they will also need to be evaluated to improve performance under conditions caused by changing water availability, water demand and water quality. A recent study of water supply and sanitation services shows that many are not resilient to climate change impacts.

In the field of agriculture, climate change is expected to impact both rainfed and irrigated agriculture, including feed and fodder for livestock. Climate change will alter the distribution of agriculture across the globe, shifting potential to high latitude areas, whereas in low latitudes, more frequent and severe droughts and floods will hurt subsistence agriculture in the semi-arid zones. This shift will worsen the living conditions of rural populations who live in fragile environments and depend on agriculture for their livelihood. These communities face an immediate and increasing risk of crop failure or loss of livestock and fertile topsoil owing to greater erosion. The challenge is to increase the ability of rural populations to cope with climate change impacts through enhanced resilience and preparedness, including diversification into non-farm-based activities.

Several densely populated farming systems in developing countries are at risk from the impacts of climate change. Severe reductions in river runoff and aquifer recharge are expected in the Mediterranean basin and in the semi-arid areas of the Americas, Australia and South-

ern Africa, affecting water availability and quality in already stressed regions. The large contiguous areas of irrigated land associated with river deltas are also at risk – from a combination of reduced inflows, change in annual flood cycles, increased salinity and rising sea levels. In irrigation systems that rely on high mountain glaciers for water, high runoff periods will advance earlier in the spring, when irrigation water demand is still low.

In addition, rising temperatures will increase crop water demand. To address water shortages, more needs to be done, especially for rural women and youth who bear most of the brunt. Other than water-related land use and tenure changes, tasks could include integrated supply and demand management of water resources, increased water storage infrastructure (surface water and groundwater), watershed development, rainwater harvesting, water conservation and community initiatives that better integrate land and water management.

From a water and health point of view, climate change will influence human health through water-related impacts of various kinds. Changes in the composition of aquatic ecosystems will impact the nutritional status, exposure to health risks and access to health services for communities whose livelihoods are closely linked to such ecosystems. The occurrence of opportunistic invaders in particular, such as cyanobacteria in lakes and reservoirs, will pose new challenges for water service companies. There has been a resurgence of water-related vector-borne diseases in areas where eradication programmes had previously been successful, and emergence of new vector-borne diseases in areas where they were previously unknown (for example, transmission of the Chikungunya virus in Italy, and the continuing spread of dengue fever in northern Argentina, northern Australia and in southern China). Although it is difficult to identify the different driving forces, climate change cannot be excluded. Reduced nutrition and access to safe water for human consumption and personal hygiene may compromise ba-

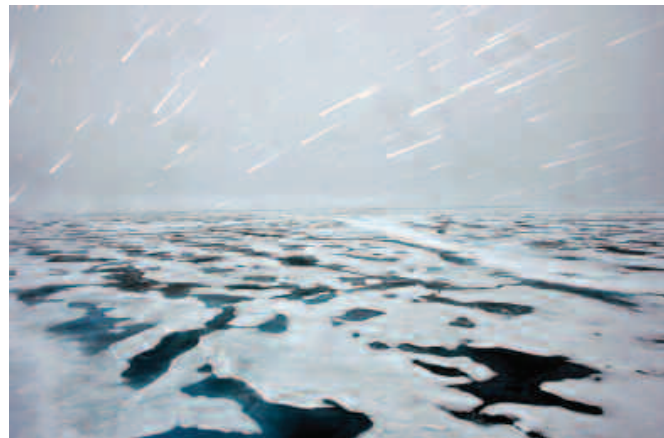


Fig. 7. View of polar ice rim. Source: UN Photo/Mark Garten.



sic human health and in particular affect the health burden caused by diarrhoeal diseases. Malnutrition owing to water shortages and limited safe drinking water during flooding may induce outbreaks of water-related diseases. New breeding places for mosquitoes and other disease-transmitting insects may also develop. Groundwater resources may also need improved protection against contamination from extreme rainfall and floods.



Fig. 8. Flooding in Punjab province, Pakistan.
Source: UN Photo/Evan Schneider.



Fig. 9. Coping with disaster: drought in Senegal.
Source: UN Photo/Carl Purcell.

Nevertheless, climate change brings opportunities to improve community health. These health benefits could offset some of the costs of climate change mitigation and adaptation. It is important to raise stakeholders' awareness of the nature and scope of these health benefits.

Services provided by ecosystems support livelihoods and economic development. The impacts of climate change on water will aggravate drivers of ecosystem degradation, thereby reducing the benefits obtained from them, such as clean water supply, and fisheries and coastal defences. The impacts of climate change on ecosystems will increase the vulnerability of communities. Thus, actions to reduce and restore ecosystems and their services are needed to help reduce vulnerability and build resilience at the community and national levels. Such actions include upper watershed management to maintain water storage; allocation of water to ecosystems through the application of environmental flows; and restoration of flood plains and mangroves. To maximize benefits for resilience, adaptive institutions should complement these actions by implementing effective and participatory water governance.

Society needs to adapt to the full range of water-related hazards that will accompany climate change. These hazards can result from too much water (causing floods, erosion, landslides mudslides, and the like, in land-degraded areas) or too little water (causing droughts, forest fires, loss of wetlands or other habitats, saline encroachment, and the like) and from the effects of chemical and biological pollution on water quality and in-stream ecosystems. Approaches – such as Integrated Flood Management – that are robust and adaptive should be adopted to manage floods. Flood risk assessments, which form an essential element in such approaches, should incorporate climate change effects on the magnitude of floods and the vulnerability of populations. Especially for the large regions of rainfed agriculture, early warning for droughts is essential.

With the above concerns in mind, The Hyogo Framework for Action provides an internationally agreed framework for reducing disaster risks, and is an important tool for adaptation to climate change.

The Climate change adaptation UN-Water policy brief was officially launched on “Water Day” in June 2010, during the climate negotiations in Bonn.

Another shorter document was also developed through consensus and entitled “UN-Water Key Messages on Climate and Water” (Fig. 1). This one-pager was addressed to the parties of the UNFCCC, and communicates the main message that though water is key for adaptation to climate change, this is not yet apparent in international investment portfolios.

Strengthening of coordination

The WCC-TPA actively assisted in the preparation of two white papers on the “needs” and “capabilities” of the water sector for climate information in the run-up to the World Climate Conference-3 (WCC-3). They were then presented during the special session on climate and water during the event. Drafts of these papers were circulated to WCC-TPA members for their input, who further circulated them to their expert networks in different sub-sectors relevant to their respective organizations and channeled their feedback.

One of the WCC-TPA's activities stated in its Terms of Reference is to conduct a mapping exercise on UN-Water members and partners on mandates and capacities related to water and climate issues. The objectives of the exercise are to improve collaboration and coherence in the support provided by UN-Water members to Member countries, to provide support for advocacy aimed at influencing policy at global level and to provide support for country-level coordination. Transparency amongst programmes and activities is considered to be the way to achieve synergy from cooperation and collaboration.

The exercise seeks to shed light on some key questions:

What are the UN-Water activities related to water and climate change adaptation? Who is doing what, where and with whom? What are the possible overlaps, opportunities for cooperation and gaps regarding the activities of UN-Water members, in their support of the development of Member States' climate change adaptation strategies? How can UN-Water best respond to requests for support in the development of a multi-sectoral climate change adaptation strategy in a country, and if a need is identified for UN-Water to create a mechanism to efficiently address such requests, what could it be?

Preliminary results of the mapping exercise have been prepared for 102 projects/programmes, 4 of which included 317 country initiatives.

The mapping exercise results broadly revealed that the current practice is that countries requesting technical assistance to develop a climate change adaptation strategy, normally contact an agency, either at the national, regional or global level. As there is not a unique UN agency dealing with climate change, the specific agency contacted varies from case to case, but normally it depends on the affiliation of the national originator of the request. For the sustainability of a project, it is preferable to implement it through a local agency rather than with external support such as consultants. The participation of the right agencies from within the UN System can ensure involvement of the right stakeholders from within the countries. At the same time, it is recognized that adaptation to climate change in water-related projects requires a multi-dis-

Climate change adaptation is mainly about water...

Water is the primary medium through which climate change influences the Earth's ecosystems and therefore people's livelihoods and well-being. Already, water-related climate change impacts are being experienced in the form of more severe and more frequent droughts and floods. Higher average temperatures and changes in precipitation and temperature extremes are projected to affect the availability of water resources through changes in rainfall distribution, soil moisture, glacier and ice snow melt, and river and groundwater flows. These factors are expected to lead to further deterioration of water quality as well. The poor, who are the most vulnerable, are also likely to be affected the most.

Water resources and how they are managed impact almost all aspects of society and the economy. In particular health, food production and access, domestic water supply and sanitation, energy, industry, and the functioning of ecosystems. Under present climate variability, water stress is already high, particularly in many developing countries, and climate change adds even more urgency for action. Without improved water resources management, the progress towards poverty reduction targets, the Millennium Development Goals, and sustainable development in all its economic, social and environmental dimensions, will be jeopardized.

Adaptation to climate change is mainly about better water management. Integrating this and responding to it appropriately present development opportunities. Appropriate adaptation measures build upon known land and water management practices to increase resilience to future climate change, thereby enhancing water security, increasing livelihoods and integrated solutions needed at the appropriate scales, for adaptation as well as mitigation. Any adaptation measures, however, need to be assessed for maladaptation where effects, in particular on the environment and on human health.

Adapting to increasing climate variability and change through better water management requires policy shifts and significant investments that should be guided by the following principles:

1. Addressing water scarcity in the broader development context;
2. Strengthening governance of water resources management and improving integration of land and water management;
3. Improving and sharing knowledge and information on climate, water and adaptation measures, and promoting a comprehensive and sustainable data-collector and monitoring systems;
4. Building long-term resilience through stronger institutions and water infrastructure, including well-maintaining water assets;
5. Investing in cost-effective climate water management and technology transfer;
6. Releasing additional funds through investment in climate resilience allocation and innovation funding mechanisms for adaptation through improved water management.

The issue of equity for climate change adaptation and the recognition of the centrality of water therein, have not yet permeated the political world and are not consistently reflected in national plans or international investment priorities for adaptation.

It is imperative for the Parties to the UNFCCC to recognize the pivotal role of water in adapting to climate change in order to increase resilience and achieve sustainable development.

Fig. 10. “UN-Water Key Messages on Climate and Water”



Fig. 11. Members of the UN-Water WCC-TPA.

ciplinary approach, a fact that has been brought out in the Climate change adaptation UN-Water policy brief. While on the one hand UN-Water is advocating participation of various ministries within the countries to come together and adopt an integrated approach, it is equally important to set example by bringing in different relevant agencies dealing in specific aspects of adaptation in the water area. Generally, it is up to the agency desirous of initiating a project to involve the appropriate sister UN agencies in



the project and, while there are several cases where this happens, the mapping results clearly show that there are many cases where agencies which have the primary responsibility for an important component of the project are absent from the list of co-participants. It has also been noted that in many cases, the involvement (or lack of it) of other agencies depends more on personal relations rather than on institutional procedure.

For this reason, once finalized, the mapping exercise will feed into a database of activities, as a tool to encourage coordination. The database will constantly be kept up to date and it would be up to individual agencies to consult the database regularly to ascertain if there are projects where they should be involved or whether a new activity they are planning could not better be combined/coordinated with an already existing one undertaken by a sister agency.

In parallel to the mapping exercise, a gaps analysis was undertaken to allow a comparison between the activities undertaken by UN-Water members and partners, and the recommendations contained in the Policy Brief. From this transpired the need to develop guidelines on adaptation to climate change, based on existing material focusing on specific issues (e.g. agriculture, health) and following the general approach, as advocated in the Climate change adaptation UN-Water policy brief. More information about the development of the guidelines can be found in the “The way forward” section below.



Fig. 12. Workshop of the WCC-TPA in Bonn, Germany, May 2010.

Building awareness

Various activities have been undertaken, aiming at building awareness on climate change issues in relation to water. For example, at the fifth World Water Forum that was held in March 2009 in Istanbul, material on water and climate change was provided to the UN-Water booth. It is on this occasion that the then Task Force held its first meeting and started to build and shape its tasks and activities.

During COP15, the coordinator of the WCC-TPA participated in two events where the role of water management in the adaptation debate was discussed. The events were attended by the French Minister of Environment and the Minister of Transport, Public Works and Water Management of The Netherlands. The general consensus in the two panels was that there is a need for advocacy to the media for the acceptance of water as central to climate change adaptation and its inclusion in the decisions of COPs.

Also, the WCC-TPA was represented at two major media events, namely the International Media Consultation on Water and Climate Change held on 24-25 September 2009 in Zaragoza, Spain and the Deutsche Welle Global Media Forum held on 21-23 June 2010 in Bonn, Germany.

The International Media consultation on Water and Climate Change was organized by the UN-Water Decade Programme on Advocacy and Communication (UN-DPAC) in collaboration with the Spanish Ministry of the Environment and Rural and Marine Affairs (MMA), the Hydrographic Confederation of the Ebro River Basin (CHE), the Government of Aragon, the City of Zaragoza and the University of Zaragoza. The seminar brought together around 50 opinion leaders, communicators, UN representatives and experts from across Africa, Asia, Europe, North and South America. It aimed at raising awareness about the connection between water and climate change, exploring the role of communicators in shaping public opinion, and identifying best practices and information-exchange methods, among others.

Under the theme “The heat is on Climate Change” the Deutsche Welle Global Media Forum convened some 1,200 journalists from around the world. A media workshop entitled “water and climate change” was organized aiming at preparing the participants and journalists from developing countries on the theme “water and climate change” and on conference reporting on this issue. A panel session on “Water for life: Where is Water in the Climate Change Debate?” took place between four experts and was moderated by a member of the WCC-TPA. Material, including the UN-Water Key Messages on Climate and Water one-pager and the Climate change adaptation

UN-Water policy brief was displayed in the UN-Water booth, located in the exhibition area and widely distributed to the participants.

The way forward

The WCC-TPA is currently designing its next work plan for the years 2011-2012, that should focus among others, on activities aiming at establishing a strategy/plan for advocacy and communication, developing guidelines on water adaptation to climate change, and developing a coordination mechanism among UN-Water members to assist countries in facing the challenge posed by climate change in the water sector. A preliminary description of some activities the work plan may entail is to be found hereunder.

Having recognized that the time has come for the WCC-TPA to move its advocacy agenda forward, discussions about the development of a strategy/plan for advocacy have arisen. The strategy may attempt to define the best way to address the COP and CSD processes, as well as to detect their adequate entry points. It will also contribute to ensuring that the principles outlined in the Policy Brief are appropriately promoted in these events and, most importantly, are widely disseminated to the public opinion.

As mentioned above, the idea of developing guidelines on adaptation to climate change stemmed from the mapping exercise and gap analysis. In an effort to avoid duplication, 140 existing guidance documents provided by members and partners have been compiled and reviewed for relevance. A first screening narrowed the number of documents to 36. The WCC-TPA is presently engaged in a second screening that should allow a further narrowing, to about 10-15 documents, which will be thoroughly reviewed for adherence to the UN-Water agreed-upon principles. At the end of this process, if needed, new Guidelines will be developed in a collaborative way. Once finalized, the Guidelines could be implemented and further strengthen the coherence and coordination mechanism of planned adaptation projects among UN-Water members and beyond.

Another area the WCC-TPA will concentrate its work on is the strengthening of the coordination among UN-Water members and partners. This can be done through a coordination mechanism that is still being defined and could be achieved in different ways. One way could be through a joint program on climate change mitigation and adaptation in the water sector, with a joint pilot project in one of the identified countries under the one-UN (initiative aiming at enhancing system-wide coherence at the country level with the objective to ensure coordinated and more effective development operations and accelerate

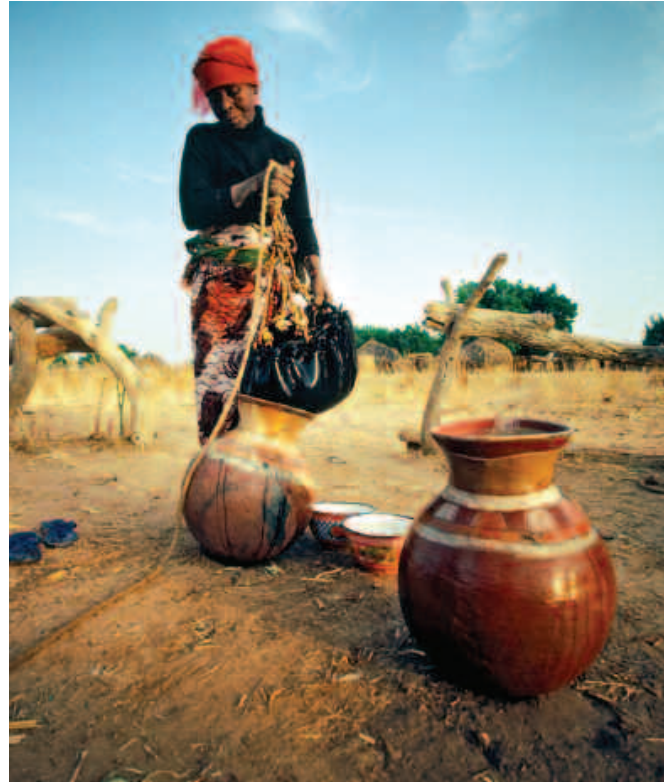


Fig. 13. Water is vital for life. Source: UN Photo/Jeffrey Foxx.

progress towards the achievement of the Millennium Development Goals), and in collaboration with the UN-Water Task Force on Country Level Coordination. Another way of strengthening the coordination of UN-Water could be accomplished through the establishment of a mechanism for informal review of planned adaptation projects. This mechanism would review whether the planned project follows certain criteria agreed upon by the WCC-TPA, as stated in the Policy Brief and in the Guidelines mentioned in the above paragraph. This approach would not only create a consistency throughout the UN system and support member countries in adapting to climate change in the water area, but would also be a good example of the UN working as one.

As in any initiative involving coordination of partners with related but widely different interests, progress is not easy and debates are abundant. Still, it can objectively be said that, in the case of climate change and water, the UN family is doing a great effort to “put its house in order”. □





UN WATER



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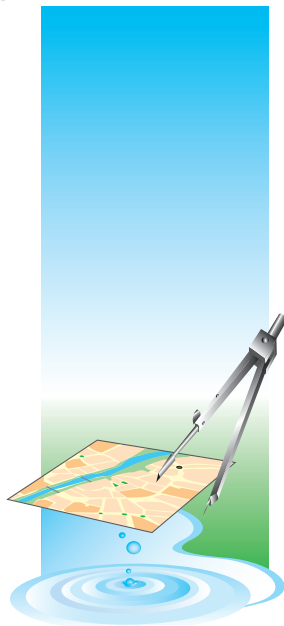
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Part two: Civic organisations and associations and water

Introduction

Tomás A. Sancho Marco

Water is the essence of life, and life is intrinsically linked to water. Water's physical and chemical properties have enabled living beings to appear, survive and evolve on this planet. We break water when we are born, water which protected us since our conception. 70% of our bodies are made up of water (and 85% of our brains)...

Water also has a less friendly face: when nature's full force is unleashed through it causing terrifying phenomena and devastating droughts, and the fact that most diseases and their transmission have much to do with water and lack of sanitation.

Society in general, civic associations and specially-trained professionals should not keep silent nor stay out of debates and action on an issue so important to mankind, to humanity's progress and wellbeing and to sustaining life on Earth.

When we consider the science and art of producing a humanized space, at one point or another we encounter water, a liquid element that, one way or another, due to its shortage or overabundance, its quality or lack thereof, decisively determines general territorial planning and economic, social and environmental development across different regions.

The twentieth century has made us look at natural resources in general, and water in particular, in a new light. Our planet has increased its population sixfold, and each person's water consumption has multiplied four times over. And water, which like any natural resource always remains constant, has become pressured by this growing, multiplied demand and its quality has fallen due to returns from ever more polluting usage.

Though for years and years, thousands of years, water has existed as a natural element, as mankind's travelling

companion, and though the history of the world and mankind is inextricably linked with water, in the second half of the twentieth century, following the technological boom, water (and other natural resources) has come to be a scarce resource and a potential serious problem.

Therefore globally, water is back as a top priority on the international political agenda, with calls for water planning and the integrated management of resources as the best way to fairly and efficiently allocate water and decide on courses of action. This means future scenarios must be anticipated, measures must be sought and defined to ensure demand is met, in a way that favours socioeconomic development, regional balance and the improvement and preservation of water ecosystems. It means combining action on surface and ground water, respecting the entire water cycle, and reaffirming commitment to basin organisations. Integrated water resources management involves all of us, because water needs to be well-managed in our own homes, it needs to be well-managed in the fields, and it needs to be well-managed in its use in production processes. Water is a natural resource and we have to manage it by respecting the natural water cycle, so exploitation is carried out in a way that truly benefits mankind, with social and economic benefits, but without the environment being exhausted and ending up paying for it.

I believe that, in one way or another, we face many challenges around water; however to summarise in one sentence, we have to apply principled pragmatism. We have to get water problems solved, which means all of us offering solutions. We should seek solutions that allow for sustainable development that truly are solutions, implemented with the widest possible consensus, without allowing discontent or residual opposition from the usual

quarters to block our actions. During this process of tuning and problem and issue solving, one must avoid categorical fundamentalism which could lead to water, in its essence something simple and humble, becoming a tyrannical resource which regulates non-essential uses, customs and social realities. Put more clearly: Sectorial policies (territorial, industrial, agricultural, energy...) must take into account water's limitations, however it would be illogical for water policy to be the determining factor, above all other considerations, of these other policies.

With this process, and also in this new era we are facing, it is very important to establish which principles, rationale, ideas and actions should continue to be accepted, and, on the other hand, which should be abandoned and substituted with new ones in order to complete a harmonious and coherent collection capable of responding to current challenges and those of the immediate future.

When the WCCE (World Council of Civil Engineers) and the College of Road, Canal and Port Engineers started work on this special issue of *Ingeniería y Territorio* (Engineering and Territory), we considered, felt and expressed the need to launch a key message with two elements: *We have to act, with* and based on *professionalism*.

Action is needed to make the human rights to clean water of sufficient quality and to basic sanitation services effective and real. Decisive action is needed now to confront this scandal for our species that hundreds of millions of people still lack these basic rights. Action is also needed to supply regions and towns with water for sustainable development. We do not lack the capacity, nor the means, at a global level. What we do lack is solidarity and decisiveness.

However we must act with professionalism. We water professionals have a clear and direct social responsibility to contribute our experience, ability and expertise in order to make this process possible, to extend and intensify our predecessors' magnificent work. When a tap is turned on and water flows from it, a lot of work has gone into it beforehand..., and more work will happen afterwards. Solving water problems, supplying it where, when and however it is needed, facilitating its use in an environmentally-responsible and proper way, is neither easy nor instantaneous. Taming water, always capricious, always irregular in space and in time, requires ingenuity and the application of artifice and work to achieve its regulation, transport, distribution, sanitation, treatment, etc. and requires the integrated management of water resources, which in turn requires specially-trained staff and professionals.

We must contribute our experience, abilities and knowledge and be willingly involved in the desirable social and participatory processes that go along with everything involving this fluid, so vital to everyone and everything.

It is better we be accused of wanting to unduly interfere in water policy than to abstain from the process and permit, through passivity or omission, a hollow policy full of empty promises, empty words and inaction, mere toying and froing, or containing mistakes arising from not being based on serious proposals derived from due analysis, technical studies and assessments that would furnish the necessary rigour and sound basis required.

We hope the following articles offer, from an in-depth, diverse, multifaceted and non-alarmist viewpoint, a valid contribution and encourage the dissemination and discussion of water topics, and active participation on them.

All the articles, to a greater or lesser extent, include analytical sections and sections with proposals. They collect together the vision (not at all reductionist, but certainly suggestive) offered by those who know the problems and solutions available for urban water cycles better than anyone (operators and managers who carry out invaluable work), and the perspective of seasoned communication professionals who state that water has a great potential to become an element of debate and conflict, and thus needs to be properly conducted and managed to become an agent for solidarity, cooperation and progress. To a list of reflections and proposals for the world's water made from an engineering viewpoint (neither prudish nor short-sighted, highlighting how current world crises interplay, and how action is needed to achieve the coveted solutions), we add more specific statements on the need, sense and scope of water planning, with the particular example of the Spanish experience, and a proactive analysis of water in Latin America which highlights the productive use of expertise and abilities acquired, making a virtue of necessity, in these parts.

Finally, we share our country's successful initiative, the Spanish Cooperation Fund for Water and Sanitation, which perfectly embodies and represents the spirit and meaning of this publication: combining efforts to carry out a correct political decision, with qualified technical, professional support, which can be trusted with implementing it and putting it into practice, using a financial mechanism that shows solidarity and that should make it possible that wherever the Fund is applied, water ceases to be a problem and instead offers opportunities for the dignity and development of its recipients.

The reader will be the judge of how well we achieved our goal. Whatever the verdict... *Act now!* □

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The world's water operators

Ángel Simón Grimaldos and Fernando Rayón Martín



KEYWORDS
 SUPPLY
 MDG
 RIGHT TO WATER
 GLOBAL CHANGE
 RESOURCES
 DEMAND
 EFFICIENCY
 INNOVATION
 MANAGEMENT
 REGULATOR

The global challenges of water

Challenges raised by the Millennium Goals

The water-related Millennium Development Goals (MDGs) establish halving the proportion of people without access to clean drinking water and basic sanitation services by 2015 (Figs. 1 and 2).¹

According to the WHO, apart from the obvious improvement to the lives of millions of people, there is also a potential for economic profit of 3-34 dollars for every dollar invested in sanitation and drinking water.²

Nonetheless, the challenge is huge, and to achieve it all public and private institutions involved in water management in any way will have to be involved. In particular, the involvement of professional water operators is essential to achieve these targets.

The close relationship between the Millennium Goals and the right to water access

“Access to clean drinking water is a fundamental human need and, therefore, a basic human right. Contaminated water jeopardizes both the physical and social health of all people. It is an affront to human dignity.”

Kofi Annan, United Nations Secretary-General, 2003.³

By formalising the *right to water* it is hoped that everyone will be entitled to sufficient, safe, acceptable, physically-accessible and affordable water, which should be enjoyed without discrimination by both women and men.⁴

In 2002, the United Nations’ International Covenant on Economic, Social and Cultural Rights recognised water as an independent right in itself. Based on a series of treaties and international declarations, it declared: “The right to water clearly falls within the category of guarantees essential for securing an adequate standard of living, particularly since it is one of the most fundamental conditions for survival.”⁵ However, if rapid progress is not made towards achieving water’s MDGs, the universal right to water will be nothing more than an empty statement. An estimated 6.7 to 75 billion dollars of economic resources a year will have to be employed to achieve water’s MDGs (Fig. 3).⁶

In addition to investment in infrastructure itself, it is fundamental to plan for the technical and economic mechanisms necessary for said infrastructure’s proper operation and maintenance. The world is full of examples where, thanks to international cooperation on finance, the necessary infrastructure has been built, but afterwards, due to the lack of an adequate management model and an effective regulatory framework, or an absence of organisational, technical and economic mechanisms to operate and maintain the infrastructure, it has been all but abandoned soon after beginning to operate.

As such, governments, financial institutions and water operators must work together to put the necessary processes and systems in place to achieve the MDGs and make the right to water a practical reality.

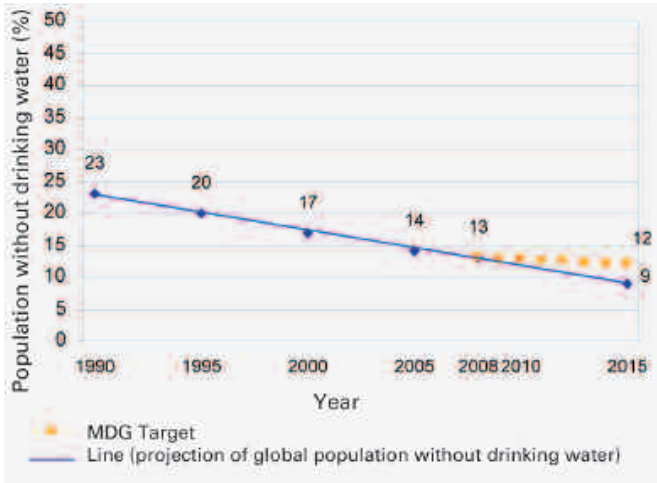


Fig. 1. MDG progress on clean drinking water.

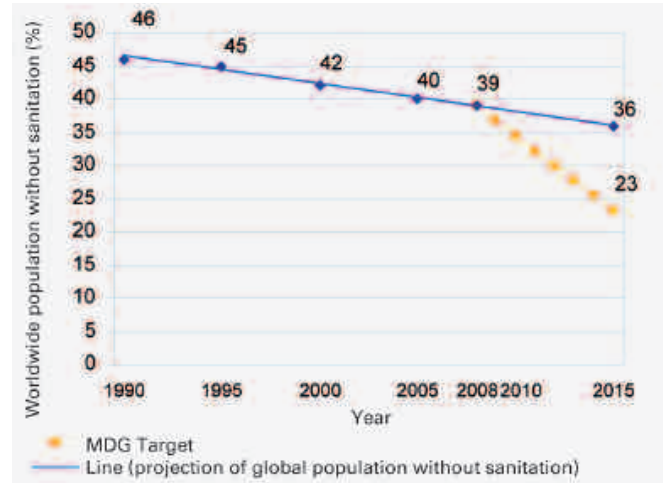


Fig. 2. MDG progress on basic sanitation.

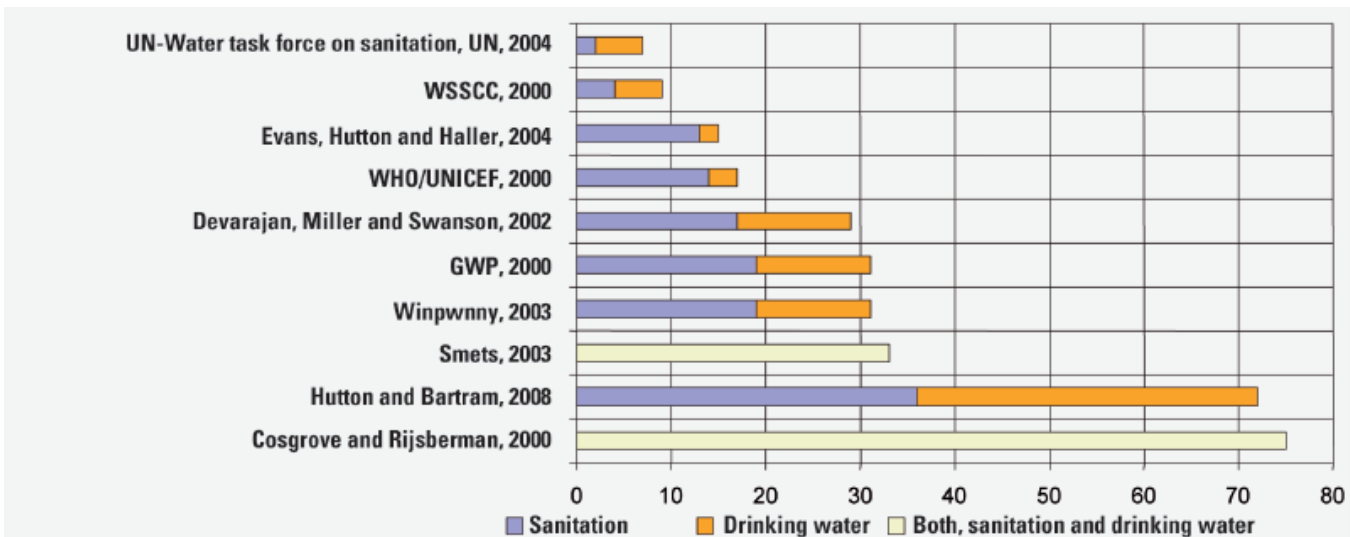


Fig. 3. Estimated costs (in billions of dollars per year) to reach MDG drinking water and sanitation targets. Source: Adaptation by Fonseca and Cardona (2005); Hutton and Bartram (2008).

The Millennium Goals and the challenges of global change

The MDGs are not the only challenges faced by water management in the world. Water is also significantly affected by what is known as “global change”. Global change refers to a whole set of different changes caused by human activity on the environment and its resources. Climate change is a part of it, however there are also many other equally, or even more pressing elements such as urban overpopulation, economic growth and globalization of markets (with their attendant social and environmental consequences) and land-use change (deforestation, reforestation, urbanisation...). All these changes significantly affect the water cycle, since they usually increase demand for water, and, simultaneously, reduce the availability of water resources (both its quantity and quality, since contamination of water sources also increases). These factors combined means an increase in water stress, i.e. there is not enough water to meet demand (Fig. 4).

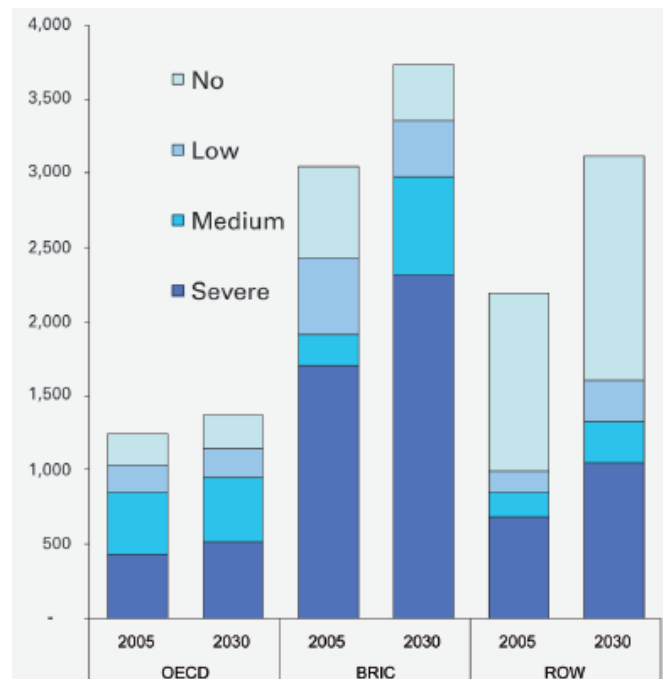


Fig. 4. Populations in areas of water stress, by level of stress (millions of people), according to various estimates. Source: OECD (2008).



At this point it is worth noting that at a global level, agriculture is the largest water consumer with 70% of the total (Fig. 5).

Furthermore the FAO predicts that worldwide agricultural production will increase by up to 55% by 2030 and 80% by 2050 in order to satisfy demand for food from the world's growing population (and its increasingly rich diet) – water use associated with a 2,000 kcal per day diet for the additional three billion people forecasted for 2050, is six billion additional cubic metres of water.⁷ More irrigation will be needed – the 55% increase in food supply required by 2050 will require 40% more water use by agriculture.⁸ For this reason, improving the efficiency of water use in agriculture is essential. It is estimated that a 35% improvement in the efficiency of irrigation techniques (perfectly plausible with present agricultural knowledge) could reduce the additional water needed for crops from 80% to 20%.⁹

Until now we have looked at challenges fundamentally associated with emerging or developing countries. Developed countries also face challenges such as: better guaranteeing water supply during droughts, safeguarding the ecology of water bodies, progress on zero-impact processes and minimising energy consumption through the reduction of water use itself and by reusing by-products of energy production. Also, work is being done on the concept of *full cost recovery*, that is, working towards recovering the overall costs of water management, costs that in-

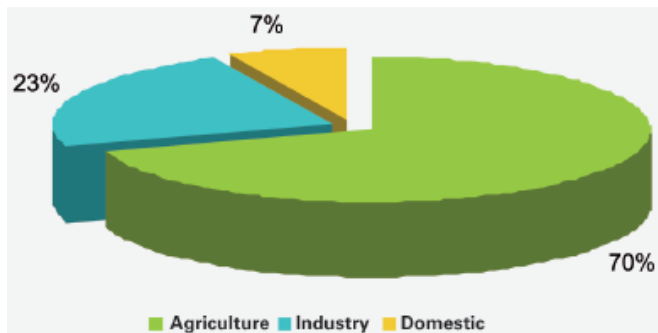


Fig. 5. Global distribution of water use.
Source: *Vital Water Graphics*, UNEP.



Fig. 6. Bristol Water. Dam Chew valley. Bristol, London.

clude environmental costs and opportunity costs as defined by the European Water Framework Directive.

Basic requirements for facing global challenges

A wide network of efficient infrastructure is an essential element in a country's competitiveness. In the case of the water sector, an adequate infrastructure that ensures the supply and quality of water are vital to the development of the economy. Today, in some areas, there is no guarantee of supply due to insufficient infrastructure, which becomes increasingly evident during the periods of drought we are experiencing in many countries. So, to better ensure supply, we must build an infrastructure which can reach new resources or manage existing resources more efficiently. In any case, scarcity of water resources means that in the majority of cases, both methods will have to be employed.

In other areas, antiquated infrastructure and its often deficient state of preservation (which leads to leaks and major loss of water) also causes problems.

Lastly, regarding water used in irrigation (as we showed, 70% of all water use), the efficiency of its transportation and water distribution infrastructure could be significantly improved; modernising irrigation systems must be a key target for water management.

The support of multilateral financial institutions is fundamental to the process of building infrastructure. However, as we have seen, it is not only new infrastructure that is needed to improve efficiency and productivity in the water use. Meeting the challenges of water in developed countries will not only require the construction of new infrastructure but also the operation, maintenance and replacement of present functioning infrastructure or infrastructure which has reached the end of its useful life cycle. Recognising the importance of infrastructure management is vital to guaranteeing its efficient and sustainable operation.

Another key economic aspect is the price of water, a very controversial topic, for ideological and social reasons.

Presently, tariffs on the majority of the world's water services rarely cover the investment and operating costs (Fig. 7), and thus have to be complemented by other sources of finance. Nonetheless, there is an increasing trend towards cost recovery according to the different uses (considered in the European Water Framework Directive). This principle tries to guarantee the autonomy and economic sustainability of the service and encourage responsible, not wasteful, use of the resource. However given the irreplaceable and essential nature of the raw material, it will always be necessary in many cases to establish subsidy mechanisms for the most economically-disadvantaged populations, mechanisms which are properly structured to discourage the wasting of water.

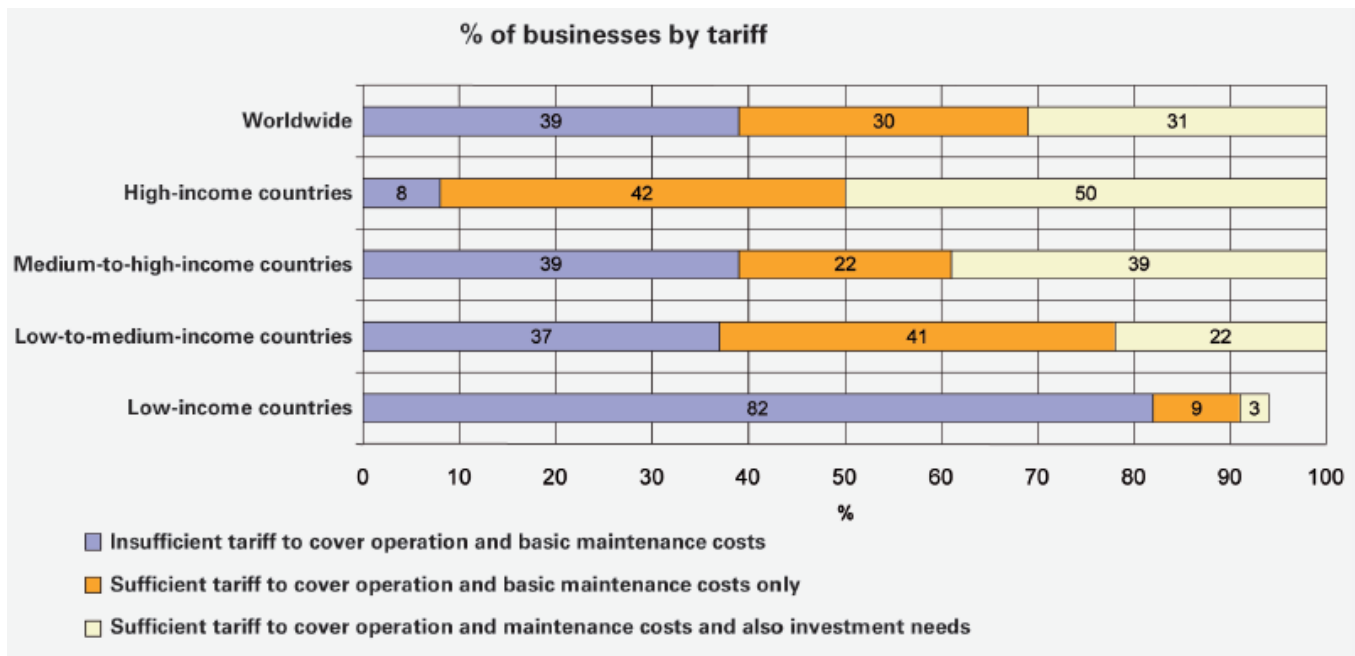


Fig. 7. Levels of cost recovery through tariffs in different countries. Sources: The World Bank (2005) in UCLG (2009).

Major water challenges faced at both international and local levels also require new approaches and solutions. As such, it is vital to redouble our research, development and innovation efforts. These efforts should not only focus on *hard technologies*, but also the *soft* ones: those of management. The magnitude of these challenges means that businesses must work together with the scientific world and government to innovate and find new solutions. A model of innovation is needed that is based on partnership between universities, government and businesses, sharing their efforts and collaborating as much as possible with international companies and organisations.

Key concepts of water management

Some key concepts: water as a public/private product compared with public/private management of services

When talking about water, there is often confusion over the meaning of terms like *privatisation* and *private water management*. In this context, it should be clarified that *privatisation*, understood as the kind of operation whereby *something* is transferred to a private organisation, can relate to everything from *ownership of the product, water* to *ownership of the service* of water management, including *ownership of the water-management infrastructure*. There are, therefore, very different meanings to the concept of *privatisation*, which are often used indiscriminately and thus generate confusion.

In the case of *privatisation of the product, water*; ownership, that is, the property rights to water, is assigned to a private entity: water, therefore, is a private product like any other, unrestrictedly subject to the laws of supply and demand.

Table 1			
Water entitlement in Europe			
Public	Public franchise	Mixed	Private
Greece	Denmark	Austria	England
Holland	France	Ireland	Wales
Northern Ireland	Spain	Luxemburg	
Scotland	Italy	Belgium	
	Finland	Portugal	
	Sweden		
	Germany		

Source: Aqualibrium, European Commission, 2003.

In Spain, the *ownership* of water, being a public product, corresponds to the State, and as such it is the government that has the power to conditionally grant its use to other users. This is the most widely used scheme in Europe as shown in table 1.

On the other hand, for *privatisation of water infrastructure*, the infrastructure is owned by a private entity. This is the case in the English model, where the privatisation of water services involved the purchase of the infrastructure by private management companies. This has led to greater investment in infrastructure than during the public era, and has also led to better overall efficiency.

Lastly, in the *privatisation of service provision*, water and water infrastructure remain under public *ownership*, however purely operative water management activities are delegated to a private organisation through an administrative contract, generally via franchises. It should be made clear that delegating service provision in this way does not mean reducing the government's jurisdiction over it, since it is still the title holder and has full control over the delegated management. In Spain, in the field of urban water, it is the most widespread form of management.



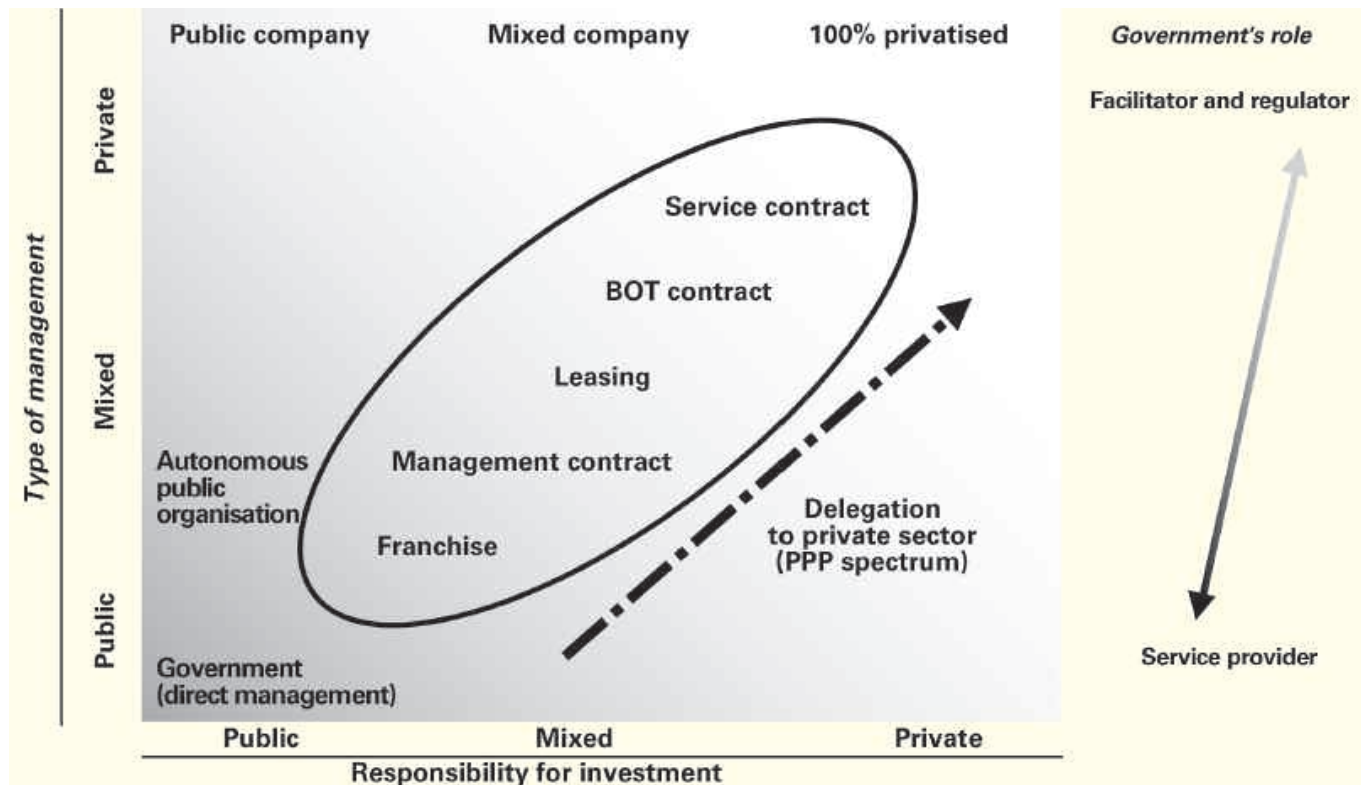


Fig. 8. PPP Spectrum. Adapted from Webster and Sansom (1999) and from the UNDP, Bureau for Development Policy.

Which is the most appropriate management model?

It is worth underlining that there are different styles of management operating within each scheme, as much in situations where the legal entitlement of water, infrastructure and operation are public as when water, infrastructure and management are private, along with almost all the possible permutations in between. In all these cases there have been successes and failures, showing that the type of privatisation model employed is not the main determining factor in their success or failure. What determines success has more to do with the following conditions being met:

- A well-defined, suitable regulatory framework.
- A guarantee of legal safeguards.
- A politically-independent, technical and professional regulatory entity.
- A professional public or private operator with incentives to improve management, technology and know-how.
- A tariff system suited to the payment capacity of the end users.
- A well-structured subsidy system that is independent from the operator and that discourages wasteful use of water.
- A guarantee of long-term economic sustainability of the service provision.

If these conditions are met, the service can be provided with quality, regularity, and sustainability, no matter which management model was finally adopted.

That said, it should be pointed out that in any case, from an objective point of view, the separation of the roles of regulator and operator, which occur in private service

management, establishes a clearer, more solid regulator-regulated mechanism than with direct public management, where the civil service/government is both regulator and regulated, i.e. it self-regulates.

On the other hand, having a professional and technologically adept administrator generally leads to better efficiency, and it is easier for a private administrator to develop these characteristics since they tend to have wider experience than public administrators who tend to be limited to their exclusive municipal areas. Furthermore it is easier and more common for private companies to be more agile, flexible and efficient, which improves their service operation capacity, meanwhile governments are usually better at *administering* than *operating and maintaining*.

Private management of water services

Typology and description of private management of water services

Public-private partnership has reached many areas of the public sector: health, education, transport, energy, telecommunications, etc. It is therefore not surprising to see it in the sphere of urban drinking water supply and sanitation. Known as the PPP Spectrum (Public-Private Partnership), it covers different methods of service provision, and can range from 100% public management to 100% private management. Within this PPP spectrum there is room, according to the laws of different States, for various different contractual methods. The most common ones in Spain are: Franchises and mixed companies (Fig. 8).

As has been shown throughout this article, the main advantages of private urban water management services can be summed up as follows:

- 1) Transparency in the respective assumption of responsibilities by the government and by the company, thanks to differentiation in the roles of regulator and regulated. The regulator-regulated relationship encourages greater efficiency in service provision.
- 2) Increased and more specialised, technological and management “know-how” from operators with proven experience who are used to *working on the network* (which makes *benchmarking* and the implementation of continual-improvement schemes possible in the cities where they operate).
- 3) Better agility, flexibility and capacity to respond to new requirements, are characteristics generally associated with private sector companies.
- 4) More capacity for financial investment- elementary for viable investment plans which otherwise may be left unimplemented.

Description of private water management in the world

Table 2 shows the extent of public or private ownership of water and management of the drinking water supply in Spain and the rest of the world.

To evaluate what private service management is capable of providing, Philippe Marin studied more than 15 years of PPP experiences and stated that “[...] well-de-

		Spain	World
Water as a product		Public	Public/private
Service	Responsibility	Public	Public
	Operation	Public (50%) / private (50%)	Public (95%) / private (5%)

N.B. Percentages refer to the supply service.
Source: Asociación Española de Abastecimiento y Saneamiento de Agua (AEAS); Pacific Institute, *The World's Water 2004-2005*.

signed partnerships between the public and private sector are a valid option for overcoming poor performance in water services in developing countries”¹⁰

Contrary to popular belief, private water management in developing countries has not been a failure, quite the opposite, other than a few isolated cases, which have garnered a lot of media attention, the vast majority have been positive experiences. Thus, according P. Marin’s work cited above, 84% of the more than 260 contracts granted since 1990 were still operating at the end of 2007. Only 9% had been cancelled early. It is estimated that public-private partnerships provided water to more than 160 million people in these countries in 2007.

Nonetheless, as already shown, this public-private model also has its detractors, who base their arguments on cases where this model was used but ended up failing. Although closer investigation shows that these failures were unsurprising given the background conditions where the model was used: marked legal uncertainty, unfavourable circumstances and background liabilities which had not been considered or corrected, for example:

- Not meeting the real needs of the inhabitants.
- A badly defined and/or unstable legal framework.
- Assigning social or political functions to the private operator.
- Political interference in the provision of the service.
- Lack of balance in the financial-economical side of the operation.
- Erroneous evaluation of the end users’ ability to pay when fixing tariffs and subsidies.
- Legal insecurity, uncovered or very high country and exchange risks.

So, what variables influence the success or failure of the privatisation processes of public services? How can the motivations of both public and private parties be met so as to ensure this success? The socioeconomic circum-

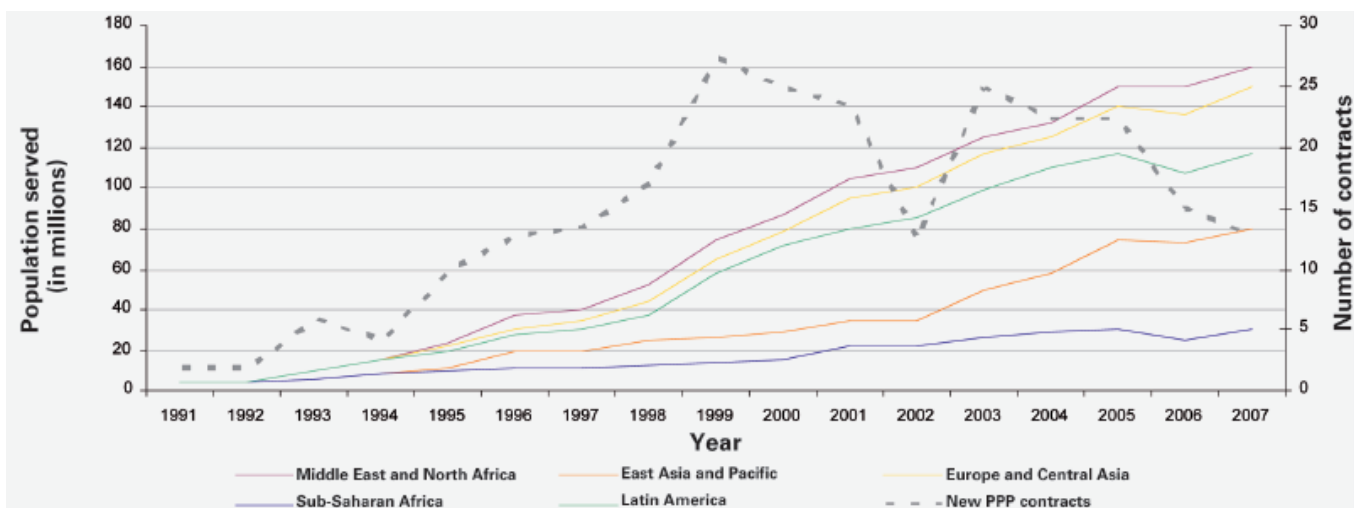


Fig. 9. PPP Contracts granted and urban population served in developing countries. Adapted from Phillippe Marin (2009).



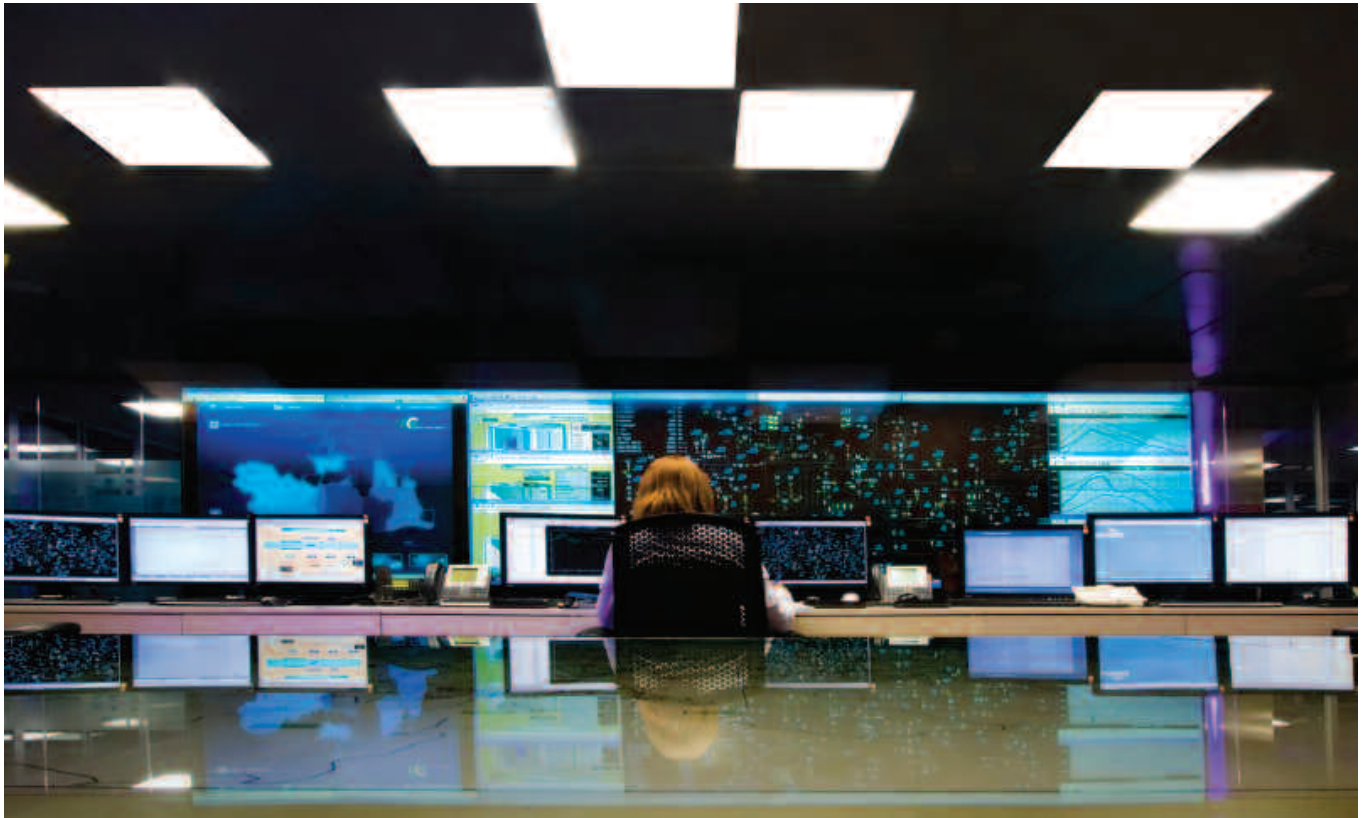


Fig. 10. Operational Control Centre of the Sociedad General de Aguas de Barcelona.

stances and political and economic stability of the place where the investment will be made play an extraordinarily important role in these issues. It is vital that the investor evaluates and surveys the risks involved and that they anticipate sufficient profitability proportional to the risk assumed. The regulatory framework should be defined in a solid and precise manner before the private operator enters, to avoid improvisations and adjustments a posteriori.

In the tendering process, it is essential to clearly define which roles will be played by the public and private sides, including these in the contract and taking special care to not assign to private operators responsibilities which essentially correspond to the civil service or vice versa.

The tendering and adjudication process must also be clean and transparent. Objectivity in choosing the future manager of the service is vital. For this reason, it is advisable to determine the evaluation criteria for the future service manager beforehand. Essential criteria should include the existence and compliance with an operational code of ethics for the operator. This can help uphold commonly-accepted international standards of corporate social responsibility.

Another critical point is the process of tariff fixation: It must be well defined and well understood by both parties. It is also important for the regulator to understand that, given a certain level of coverage and service level, there is a minimum tariff below which the financial-economic balance would break down, and which would make the oper-

ation unsustainable in the future. On the other hand, the operator should strive, as is their duty, for maximum efficiency in order to operate with the lowest possible costs.

AGBAR's experience

Spain has a topography and climatic and socioeconomic range which have always made for complex water management schemes. Thus, throughout history, the many cultures that have passed through Spain have each had to deal with these issues in every period of history. Each one has made their own contribution to methods of collecting, treating and using water. The complexity of water management in Spain has led to ingenious and innovative developments by both the government and the private sector. In the future, the challenges we have seen for the water sector at an international and local level, present opportunities for the technology, technical and managerial knowledge developed in Spain to be widely and effectively adopted worldwide.

In the specific case of AGBAR, more than 140 years ago the Sociedad General de Aguas de Barcelona (the group's parent company) started providing drinking water services to certain areas of Barcelona. In the following years, it kept expanding its service to more neighbourhoods in the metropolitan area until today where it now provides water to 23 municipalities with a population of around 3 million inhabitants. After expanding their business model initially to cover the rest of Catalonia, and

then the rest of Spain, in the 90s it started expanding internationally. Today, the Group has a presence in all the Spanish autonomous regions, providing water to more than 18 million inhabitants and managing the water treatment for the equivalent of 14 million inhabitants. In the international sphere, AGBAR is presently operating in Algeria, Brazil, Chile, China, Colombia, Cuba, Mexico, Peru and the United Kingdom, providing drinking water to 26 million people all over the world.

This experience highlights the clear efficiency of the public-private partnership management model. The key has been adapting the model to the individual characteristics and idiosyncrasies of each location, applying the scheme best suited for each case (Fig. 8), along with the use of the best technologies and know-how available, which at the same time has been continually improved by incorporating the positive results obtained during each new operation.

Some of the most notable results include:

- Significant progress in treating water in Santiago, Chile, where in the four years following privatisation, treatment coverage increased from 3% to 40% (for a population of 6 million inhabitants) and which will reach 100% by 2010.
- Reduction of gas leaks in the Mexico's Saltillo Network, which, in just four years, improved its performance from 50% to 72%.
- Improvements in Cartagena, Colombia, relating to clean drinking water coverage (from 73.56% to 99.9%), service continuity (from 60% to 99%) and in the length of the distribution network (from 700km to 1,400km), etc.

- Full implementation of 24-hour water service continuity in Havana, Cuba, where their famous *pipas* or drinking water delivery vans no longer circulate.

Conclusions

The water sector faces very important challenges that stem from water being indispensable for life and human dignity (Millennium Objectives), and because of the effects of *global change*. To face these challenges, all parties involved in the water sector must unite their efforts. Professional water operators in particular have an important role to play by partnering to improve efficiency in the management of infrastructure and present and future systems. Public-private partnership for water management is a very effective tool for progress. Because of this, our government should encourage public-private partnership models, as they are fundamental not only for efficiency in water management, but also for improving the experience and capacity of our businesses to export this model to other countries, thus improving water management worldwide and strengthening our economy and international presence. □

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World water disputes: towards an international solution

Eliseo Bayo



KEYWORDS

WORLD CONFLICTS DUE TO WATER
WATERS SHARED
TRANSBOUNDARY WATERS
INTERNATIONAL LEGISLATION

There are wars fought in many parts of the world not for oil, nor raw materials, but for water. The reason behind major wars is unresolved disputes over water rights.

Competition over water ownership makes eternal enemies of neighbours who should coexist peacefully, working together to solve their problems. In fact, the Latin root of the word *rivals* refers to those who have water rights to the same brook or stream, and *rivalry* comes from *rivalitas*, which means the situation resulting from conflict between parties over water use.

The oldest conflicts in the world started because of disputes over water or, to be more precise, access and ownership of it. Over the last fifty years, a quarter of all water-related conflicts were hostile in nature. Although the majority didn't escalate further than verbal confrontation, there were at least 37 occasions where weapons were fired, a dam was destroyed or the military intervened. The Iraq War demonstrated how water could be used for military purposes, by cutting off its supply to besieged cities, and the same thing frequently happens in the ongoing siege between the Israeli army and the citizens of the occupied territories.

Although water disputes do not always lead to war, they are a constant source of regional instability for decades, preventing economic development and causing further incidents.

In the world today there are more than 300 live or latent conflicts due to water shortage and disputes over who owns it, instead of sharing it. Exactly 261 rivers in the world are shared by two or more countries. If existing rivalries within each country over the use of rivers crossing different provinces or districts were included, the number of conflicts multiplies for each geographical location. Nearly 60% of all available water comes from international

flows used by 40% of the global population. It is, without doubt, the most widespread scene of conflict. Analysts predict there will be even more wars over water access if the international community does not adopt measures, based on treaties between parties, to break the downward spiral. Disputes proliferate between regions in the north and south.

From Israel to India, from Turkey to Botswana, there are conflicts. The Tigris and Euphrates rivers show how water independence for countries sharing the same rivers can become a reason for conflict, because in Turkey they are underutilised bodies of water while for Syria and Iraq, Turkish dams are a threat to the way of life of hundreds of thousands of their farmers. Syria and Iraq are fervently opposed to Turkey building dams to store water from the Tigris and Euphrates. Iran and Iraq compete over the Shatt al Arab river. Egypt, Sudan and Ethiopia fight over the Nile, whose basin is shared by ten countries, of which Egypt is last in line. Two thirds of all water consumed in Israel comes from the occupied territories, whilst almost half of the water systems are in areas that did not belong to Israel before 1967. The territorial dispute between Israel, Palestine and Jordan starts with the discussion about water from the river Jordan, which is controlled by Israel. A future Palestine State is unfeasible without first solving the problem of water resources according to international laws. In the 2006 Lebanon War, Israeli bombing destroyed irrigation canals flowing from the Litani river to the agricultural areas all along the coast and part of the Beqaa Valley, threatening the supply to thousands of people. At about the same time in Sri Lanka, the Tamil Tigers' refusal to open a corridor for canals to supply farmers with water led to large-scale military intervention which took the lives of 17 workers.

The same is happening in China and India, where the Brahmaputra river has caused tensions in the past between the two countries, tensions have surfaced again due to China's proposal to divert the river's course. Governments of many states in the immense Asian region that share the same wide rivers, fear their neighbour's actions will leave them without water, which would be a catastrophe for them that must be avoided at all costs. Bangladesh considers every transfer of water from the Ganges river to supply Indian demand as an irreparable loss which will cause a massive exodus of citizens towards India.

The risk of conflict is also elevated between Uzbekistan, Kazakhstan, Kirgizstan and Tajikistan over the Amu Daria and Sir Daria rivers and the almost exhausted Aral Sea.

From Darfur, in the west of Sudan, to Mount Elgon in Kenya, lack of water in rural communities is the main cause of conflict in the African continent. Botswana, Mozambique, Zambia and Zimbabwe all fight over the Chone, a tributary of the Zambezi. There have been incidents in Mauritania and Senegal over control over the Senegal river. The Okavango, the fourth longest river in the southern Africa, flows through Angola, Botswana, Namibia and Zimbabwe, and its extensive delta in northern Botswana contains a habitat known worldwide as the "Jewel of the Kalahari". Namibia is proposing the construction of an aqueduct three hundred kilometres long which could dry up the Okavango delta.

Lake Chad in Central-Western Africa, which once sustained 20 million people in Chad, Nigeria, Cameroon and Niger, has lost 90% of its surface area over the last 30 years, and with it, the majority of the enormous variety of fish that provided good-quality food.

There is tension over the control of waters shared by Canada and the United States, and, particularly, the future of the Great Lakes, whose waters become more polluted every day. At the same time the water table is falling due to increasing urbanisation and industrial activity on the American side of the border. Protests in Canada not only go unheard, but have provoked the United States government into announcing its intention to create an armed naval guard for the Great Lakes. Similar tensions occur at the Mexico-United States border due to the diversion of water from the Rio Grande on the Mexican side before it reaches the US border.

Conflicts multiply and cover the whole planet. Experts calculate that by 2015, about 3 billion people – 40% of the population at that time – will live in countries where it is difficult or impossible to obtain enough water to meet basic food, industrial and domestic needs.

The shortage will lead to strong competition for water between urban and rural areas, between states and their neighbouring provinces, and also between nations.



Fig. 1. French contingent arrives in Naqoura, Lebanon, 2006. Source: UN Photo/Mark Garten.



Fig. 2. Chlorine tablets treating water along the Nile river, Juba, Sudan, 2006. Source: UN Photo/Tim McKulka.

The worldwide water crisis

The amount of available water on Earth – 2.5% – is no more now than there was 2,000 years ago when the world's population was not even 3% of what it is now. Wasting water worsens the issue. Agriculture consumes 70% of the water, however irrigation systems are inefficient, large volumes are wasted, badly used and often employed on crops that require large quantities of water in places where there is shortage. Because of its bad use and the lack of resources, humanity is far from having enough water for life.

In 1998 it was estimated that nearly 500 million people in the world lacked safe drinking water and that if population continued to grow at present rates, by 2025 nearly 3 billion people would be facing problems of water





Fig. 3. Niger river, Cameroon, 1982.
Source: UN Photo/Shaw McCutcheon.



Fig. 4. Nomads pause to give their camels water,
Nyala region, Sudan, 2006. Source: UN Photo/Fred Noy.

shortage, according to a report by the John Hopkins University School of Public Health.

By 1998 31 countries already found themselves in this situation, the majority of them in Africa or the Near East. In 2025, given the expected population increase, 17 more countries will be added to this list, including India.

A country is considered to have water shortage when annual consumption per person is below 1,700 cubic metres, when this falls below 1,000 cubic metres per person a year the situation is serious. In developing countries, lack of water makes progress difficult. Population grows rapidly and increases the need to produce food and supply cities and industry. The report underlines that regional conflicts will escalate, becoming more violent as water shortage situations arise.

In Africa, Central Asia, the Near East and South America, disputes over access to rivers and inland seas are increasing. Disputes can also arise within the same country. In China, the Yellow river cannot meet the demand for water along its length meaning when it reaches the ocean it is almost exhausted. In 1996, when there was enough water, the government ordered farmers not to use it because it was needed to provide energy for an oil field downstream.

The abovementioned report recommended making massive investment in water supply, sanitation and water treatment infrastructure. The United Kingdom should spend nearly 60 billion dollars over the next decade on water treatment plants in order to meet European quality standards. Hungary needs to spend nearly 3.5 billion dollars over the next twenty years to connect their drainage network system to water treatment plants.

The report also showed that the more water people use, the less there is to maintain vital ecosystems. 20% of fish species are in danger of extinction. According to the report:

- California has lost 90% of its wetlands over the last two centuries, which has caused the extinction of two thirds of native fish.

- In Egypt, the diversion of water from the Nile has virtually exhausted between 30% and 47% of commercial fish species.
- Lake Chad in Africa has shrunk from the 10,000 square miles it occupied thirty years ago to barely 800 due to overexploitation and drought.
- In Europe, the Rhine is so polluted that 8 of its 44 fish species have disappeared and still more are in danger of doing the same.
- In Colombia, in fifteen years the annual fish production of the Magdalena river has fallen from 72,000 metric tonnes to 23,000. Something similar has happened in the Mekong river in Western Asia.

The fight not only affects developing countries and Asian superpowers, but also the industrialised world. Some analysts say that together with the threat of thermonuclear war, the biggest danger facing citizens of North America over the next two decades is that all regions, all the states of the nation, will lack a guaranteed safe drinking water supply.

The need to review water-use legislation and habits has been raised, in order to adapt them to the present reality. Each state maintains its own legislation regarding this area. If a landowner finds water under their property, they have the absolute right to extract it. This means that the landowner can pump as much water as they like, without incurring any kind of responsibility even if their actions harm their neighbours or neighbouring community.

Under each state's environmental laws, states can establish controls for maintaining underground water quality. However throughout the United States, state legislation considers it a basic property right and does not control its exploitation. Because of the problems of underground water scarcity in some drainage basins, some states have established local monitoring councils, self-governing groups of users. The councils are responsibility for dealing with landowners and the management of their water reserves. It is hoped that problems can be resolved by mutual agreement. All the same, in any dispute, the legislation and

court cases will continue to consider underground water as a basic property right. In the event of disputes, the law will always be on the side of the landowner and their unlimited water use. Underground water is the source of supply of drinking water for half the population of the United States, including almost all the rural population. Pumps supply a total of around 70 cubic kilometres of water a year.

The problem worsens because the professional view of aquifers holds that they refill themselves through surface rainfall. An erroneous grasp of these facts makes people continue to deepen their wells while the water reserve supply progressively diminishes.

The reality, according to international expert Lance Endersbee, is that the United States is approaching the end of this *cowboy* phase of groundwater exploitation, and expects that the flow of water in all these basins will gradually decline until they dry up completely. The evidence is clear: water flow everywhere has been reduced. Furthermore, there are serious subsidence issues in many parts of the United States due to the continual pumping of water. Near Houston, Texas, pumping has produced subsidence of almost 3 metres, while the groundwater level has fallen almost 120 metres.

In the Arizona desert, water levels have dropped between 100 and 200 metres in the majority of the territory, with subsidence of 5 metres.

In 1952, Lance Endersbee found out about subsidence problems in the San Joaquin Valley in California. He was working with the Bureau of Reclamation in Denver and the engineers designed a canal system for irrigation. They encountered a problem with subsidence caused by water extraction. The earth was sinking by almost a metre every three years and creating difficulties in the design of the irrigation canals which followed flat routes. The subsidence continued for decades. In Kansas, underground water makes up 90% of the total water supply. It is the main source for 600 urban and rural water supply systems. The majority is used for irrigation. Levels have dropped substantially.

Almost all drinking water in Florida comes from underground sources. Their aquifer system covers the whole state of Florida, the south of Georgia and the neighbouring areas of Alabama and South Carolina. The main worry is contamination of the system and falling water levels. There is salt water penetration in the aquifers all along the coast and in the south coast along the Gulf of Mexico.

In Texas and Arizona there is a proposal to privatise underground aquifers. This would allow the government to rid itself of the responsibility for water management and leave it to the private sector. It is a dangerous proposal in a country where the inhabitants are armed, says Lance Endersbee.

Unless rapid action is taken, the great American West is about to perish, suffocated by drought, dust and sewage. Some potential measures have been announced, which, by

the way, were first published in 1960 (Jim Wright: North American Water and Power Alliance - NAWAPA). Significantly improving the water supply will not only solve the problem, but it will promote new, sustainable and lasting growth along the Mississippi from Mexico to Canada; a reforestation plan and crops will increase transpiration and continue the water cycle; the development of desalination technology, using advanced technology from the latest generation of nuclear reactors, would produce abundant, low-cost water.

There are plans to develop a continental system of water management that includes using water which presently flows into the Arctic Ocean for eastern states. A pipeline would flow through the arid regions between California and the Rocky Mountains, crossing fluvial systems until it reaches the Mississippi. A more wide-ranging version of this plan includes the east of the United States through the Great Lakes and the water systems of Tennessee and Mississippi.

Drainage basins where there will be serious conflicts

The amount of water available today in the world is almost the same as it was in the time of the Mesopotamian civilisation, although demand has grown on an unthinkable scale. Since just 1950 the renewable supply per person has dropped by 58%, whilst the world's population has grown from 2.5 billion people to 6 billion. Unlike oil, there is no substitute for water for most of its uses.

In 1995, the vice-president of the World Bank warned that "the wars of the next century will be fought over water". Kofi Annan warned the same thing, shortly before leaving his position as Secretary-General of the United Nations. A report by the American Central Intelligence Agency concluded that over the next fifteen years conflicts due to water will increase between countries where access to water supplies is disputed. There are currently disputes over water possession in than 50 countries, with varying levels of violence that include all-out war. It seems that the hardest to achieve agreements are those between litigating parties over water rights.



Fig. 5. Young mother and child on the bank of the Niger river, Bamako, Mali, 1986. Source: UN Photo/John Isaac.



Looking ahead, Sandra L. Postel and Aaron T. Wolf wonder which river basins will be the source of tension and conflict during the next ten years. The answer is that conflicts will break out in places where there are, or plans exist for, the diversion of water which could affect other countries and where there are no mechanisms to resolve disputes.

There are 17 highly conflictive drainage basins, in addition to the four major ones where old disputes are still unresolved. They affect 51 countries on five continents in every type of climate. Five are in Africa, mainly in the south, six in Asia, in the southeast. A few are permanently water and security analysts' radars.

Although for industrial economies, water does not seem to be of significant importance – as much as oil, for example, a real cause of multilateral war – in the Middle East, at a global level, it is important for economies and for regions' very existence, to the point where water conflicts can be the reason for the breakout of war.

Water scarcity is heightened by population growth, overexploitation of aquifers and rivers and by contamination of rivers due to unmonitored dumping.

Asia, critical situation

The extensive glaciers of Tibet, and their great altitude has created some of the largest river systems in the world which sustain almost half the world's population, mainly in China, India, Bangladesh, Myanmar, Bhutan, Nepal, Cambodia, Pakistan, Laos, Thailand and Vietnam.

Asia has 60% of the world's population, whilst it only has 36% of renewable water sources. China, India, Iran and Pakistan are amongst the countries most at risk of exhausting the aquifers they depend on for irrigation. Between 10% and 20% of cereal production in China and India is at risk. The paddy fields of the northern plateaus of China are drying up and that is where more than half of China's wheat and a third of its maize is grown. The same is happening in the Punjab.



Fig. 6. Monsoon floods, Dadu district, Pakistan, 2010.
Source: UN Photo/WFP/Amjad Jamal.

As large numbers of agricultural workers are forced to abandon their lands due to lack of water, violent social change will occur, repressed one way or another by the police or the army, major migrations will occur into cities and across borders. This kind of event has happened in the past.

Most recently, in Pakistan, the drastic reduction in agricultural production due to water shortage prompted a massive emigration of the rural population to large cities where ethnic rivalries flared due to the huge influx of people belonging to different ethnic groups.

Almost 400 million Chinese people, a third of the country's population, still have no access to clean drinking water.

The Indian government has approved a plan to divert water flowing from the Himalayas in order to supply the basins of 17 southern rivers and distribute water around a large part of the peninsular. The project is based on using water from 14 tributaries of the Ganges and the Brahmaputra.

International laws do not determine water ownership

Unlike oil, which is generally located within well-defined borders, flowing water, and underground water passes through several countries who generally dispute its use. International laws do not determine water ownership. Each country has its own norms to regulate use and avoid disputes between neighbours. In some, such as Spain, there are ancient tribunals which respect traditional laws which have generally since passed into modern law.

In May of 1997, the United Nations Watercourses Convention formed an International Law Commission. The problem lies in that each country fears that its upstream neighbour will take so much water that it will cause drought. There are difficulties in defining the sovereignty of flowing surface water. Water ownership is very important for the development of a market that, presently, only



Fig. 7. Clothes are dried on the banks of a river, Madras, India, 1981.
Source: UN Photo/John Isaac.

relates to domestic drinking water. Identifying the ownership of water will increase opportunities for safeguarding international relations on transnational watercourses.

Egypt signed a treaty on the use of the Nile's water with Sudan in 1959 to establish the quantity of water that could be extracted. It is estimated that in the Middle East, more than 90% of surface water has crossed international borders. Even if underground water is included in that figure, the proportion is still very high, over 60%, and it would be higher still if Turkey was excluded from the calculation. In the Egyptian economy, 95% of the water has crossed borders.

The need for basic consensus on international laws

International legislation recognises non-discriminatory access to clean drinking water as a fundamental human right and requires that the respective powers comply, however it does not establish any sanctions for transgressions. The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention, Helsinki, 17 March 1992) contains some very important measures on this, especially regarding the environmental protection. Driven by the Convention, important protocols were signed: Water and Health (London, 1999), Civil Responsibility (Kiev, 2003).

During 2008 many meetings and conventions occurred: The United Nations' activity, spurred on by the daily work of thousands of organisations worldwide, is very intense and reflects the world's concern about having safe access to water. The UNECE (United Nations Economic Commission for Europe), in collaboration with UNESCAP (The United Nations Economic and Social Commission for Asia and the Pacific) and OSCE (The Organization for Security and Co-operation in Europe) is helping governments in Kazakhstan and Kirghizstan form a commission together to deal with the problem of the rivers Chu and Talas – which was studied in Zaragoza by the Euro-Asian members of the World Water Rights Commission and the *Club de Zaragoza*. The agreement will be a stimulus for bringing the Water Convention's principals to Central Asia. Amongst the numerous and very important work sessions that recently took place, one stands out: the "Roundtable on the Human Right to Water and the Protocol on Water and Health: Making access to water a reality" organised jointly by the World Health Organisation, the Office of the United Nations High Commissioner for Human Rights and UNECE, that took place in Geneva in 2007.

Conflicts over water should be resolved through understanding and pacts with reciprocal guarantees. History proves that the militarisation of conflicts can delay or deflect the adoption of real solutions, but there is no guarantee of peace. For peace it is important to insist on the

idea of consensus and its possibility. An analysis of the 1,831 international events related to water over the last fifty years reveals that two thirds of them took place in an atmosphere of cooperation. Different countries agreed to unite their efforts and improve scientific and technological work, and 157 treaties were signed. It is possible to arrive at a satisfactory consensus. Twenty European countries depend on water from neighbouring countries for more than 10% of their needs, and five of them get 75% of their water supplies from their neighbours across the border. Historic European agreements on this subject can serve as examples to other countries.

Years ago it would have been difficult to imagine an agreement between Lesotho and the South African Union, whereby Lesotho agrees to supply water to the major metropolitan area of Johannesburg in exchange for financial aid. The Nile Basin Initiative would also have been unthinkable, through which Egypt, Ethiopia and other countries exchange the benefits of cooperation of the Nile. In Western Africa, countries that share the Senegal river, Mali, Mauritania and Senegal, have established collaboration agreements. According to Sandra L. Postel and Aaron T. Wolf – who documented the incident 4,500 years ago between two Mesopotamian cities, Lagash and Umma, in the south of current Iraq, between the years 805 and 1984 of the modern era, 3,600 water treaties were signed between countries.

An uncountable number of private and public organisations, such as the *Club de Zaragoza*, seek and propose viable alternatives to achieve a Universal Declaration of Water Rights.

Among these initiatives is Maude Barlow's proposal. Maude is a member of the Council of Canadians and of Food and Water Watch and co-founder of the Blue Planet Project, dedicated to achieving a global agreement on water with three components: A treaty on water conservation, drawn up by citizens and their governments, that recognises the right of the Earth and all living species to clean water, and commits to protecting and conserving the world water supply; a legal agreement on water between all northern countries of the world who have water and resources and southern countries who do not, to work together for justice on water issues, water for everyone and local water controls; and a democratic agreement on water between all governments to recognise that water is a fundamental human right for all. This way, all governments would not only be required to guarantee the supply of clean water to its citizens as a public service, but also recognise that citizens of other countries also have the same right to water and thus find peaceful solutions to water conflicts between states. □

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Engineering, the essential response to the challenge of water for all and sustainable development

Emilio Colón and Tomás A. Sancho Marco

KEYWORDS

WATER
WATER SUPPLY
SANITATION
SUSTAINABLE DEVELOPMENT
ENGINEERING
COOPERATION
WATERWORKS

The High Consultative Council

“Noble gentlemen, we are gathered here today for a special consultation, a query brought to us by the generation of the early 21st Century, men from 2010 to be precise. As you will have seen in the letter you received, the purpose of this consultation is to provide guidance on water policy at a historic moment which some have called a crossroads. Human beings on Earth in the third millennium (according to their present calendar) have produced feats of development that in our times were unthinkable but still find themselves facing a series of problems. Many times these problems relate to essential resources, such as water, and basic concepts, such as equality and development, and have led them to seek, at this time for deciding which paths to follow in their immediate future, and with the Millennium Development Goals established, the advice of their illustrious predecessors such as yourselves, my dear Aristocles, or would you prefer we call you Plato, as you are also known? And my dear Gaius Julius Caesar Augustus, trusting that your wisdom and knowledge may guide and enlighten the path they take.”

“My dear, respected teacher, Socrates, as you can understand, it is indeed an honour for me to find myself again in the service of such a noble task and I hope I am fit for the work that such a request entails.”

“My knowledge cannot compare to yours, my respected and admired wise friends. Your mere company on this consultation fills me with pride. From my perspective and knowledge I will try to bring whatever is needed for our far away successors, the citizens of what I believe is now known as the ‘Blue Planet’.”

“Why, thank you, generous sirs. Thus I declare the High Consultative Council convened. We pray that our task may be fruitful and provide proper guidance in the decisions of those have called us. As you well know, I am wont

to complete my endeavours and tasks methodically. Therefore, I am giving you three reference documents created by the people of the 21st Century following wide-ranging global reflection of the topic of water:

- The Third Edition of the United Nations World Water Development Report (WWDR3)¹
- Official Outcomes and Statements of the 5th World Water Forum (Istanbul, 2009) containing regional and topical documents from the presenters at the forum²
- The 2008 Zaragoza Charter and the papers presented at the Water Tribune of the International Expo ‘Water and Sustainable Development’, celebrated in the city that adopted your name, noble emperor.³

Using these documents as our foundation, we will develop our analysis, basing our arguments on them (and on our own ideas and knowledge) and we will send our assessment and answer the consultation we have been tasked with. Thus, I call you all to a meeting next week in which, firstly, we will expound on our vision of what the existing underlying problems are, according to the contents of these documents. Then, we will each give our own assessment of whether the analysis and guidance we have provided is adequate. Finally, we will agree on our conclusions and recommendations. To work, good sirs.”

Analysis and assessment: The underlying problems

“As you will have seen, all three of the base documents we have looked at contain approaches which, in some ways, coincide and in other ways are particular or specific to each one; maybe even conflicting in part. Dear Augustus, would you be so kind as to provide a comparative summary of these approaches?”

“I shall try, noble Socrates. I will argue that in my opinion, there are more similarities than discrepancies. I have tried to summarise the core themes of each of the base documents. In the Fifth World Forum on Water, the key themes discussed are water supply for sustainable development (which coincides with the theme of the Zaragoza Expo) and the implementation of mechanisms that make such a goal achievable. The WWDR3 report specifically focuses on how to accelerate the achievement of the goal of meeting mankind’s needs regarding: water supply and sanitation, health, food security, flood and drought mitigation and prevention of conflicts. It puts particular emphasis on developing countries and preventing competition between users and uses putting excessive and unsustainable pressure on natural water resources and their ecosystems. As for the Zaragoza Charter and the conclusions from the Water Tribune, they are focussed on a series of themed weeks on topics such as: water and land, water and the city, water for life (health, water quality, rivers and sustainability), water as a unique resource (claiming its management be integrated and from hydrographic basins), climate change and extreme phenomena, water economy and finance, water and society, water and energy and new water sources. Basing itself on these top-

ics, the Zaragoza Charter calls for a new, integrated vision of water and combines its findings in a series of universal recommendations aimed at public authorities, users and citizens.”

“Well, after listening to your presentation, it seems that all the documents are in line with each other. But, my dear Plato, according to you, someone who has distinguished himself in his capacity to contrast reality with knowledge, and who has been highly critical of the role of our senses, stressing the need to rely on reason and understanding to truly see reality, do you deduce from this documentation that we have a sound, objective basis for approaching the problems surrounding water? Are we seeing shadows on the cave wall, or do we really have a good representation of reality? For example, is there sound knowledge of how much water is available, where it is and what it is like? And why, what, how much, where and how it is used?”

“On reviewing the documentation provided, I would answer that, apparently, the degree of knowledge is more than acceptable. The reports contain vast amounts of data about water, as shown in this graph based their data (Fig. 1). However, not all my shadows have been dispelled, for the following reasons:

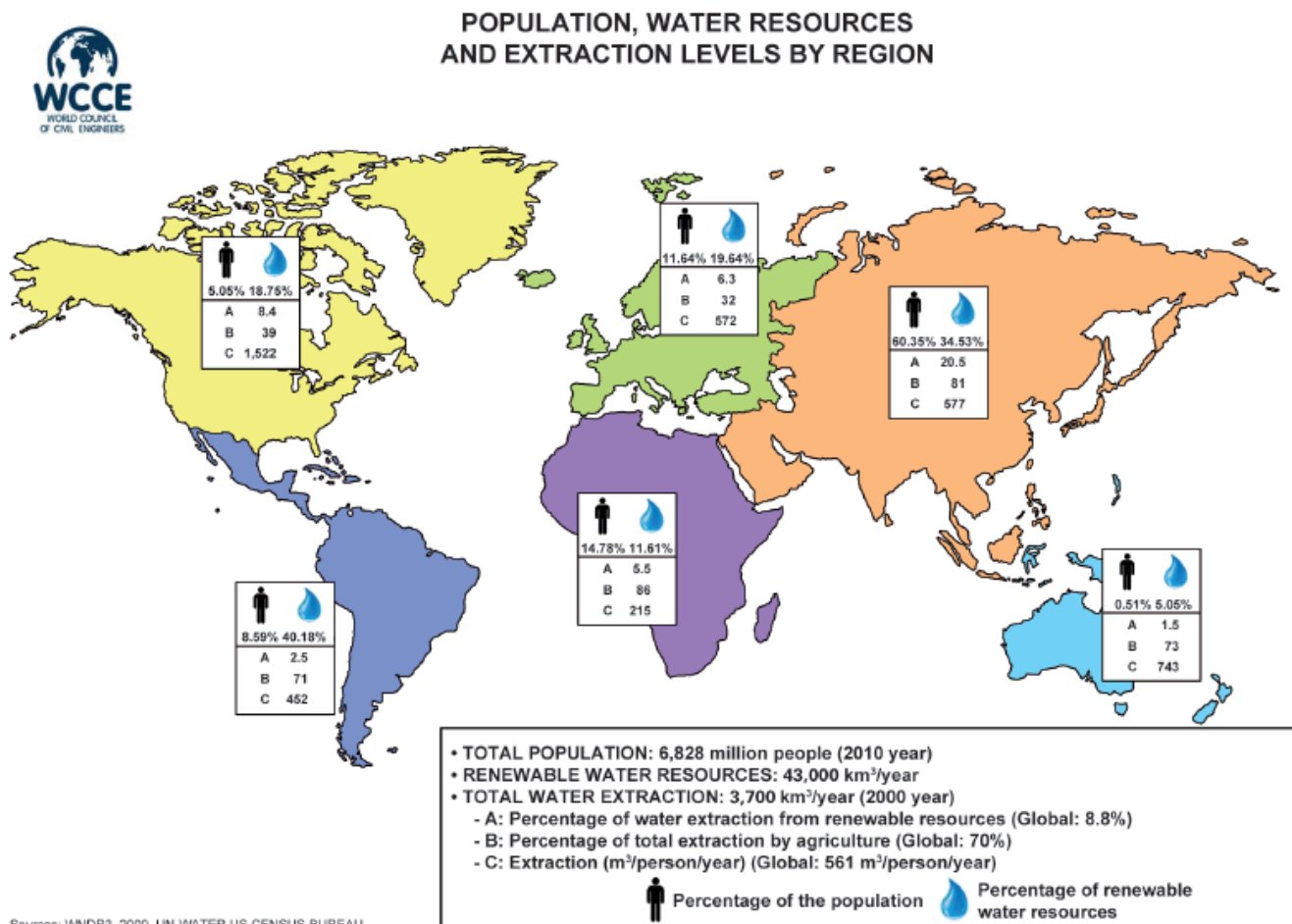


Fig. 1. Populations do not settle according to available water resources and water is not uniform in different regions of the world.



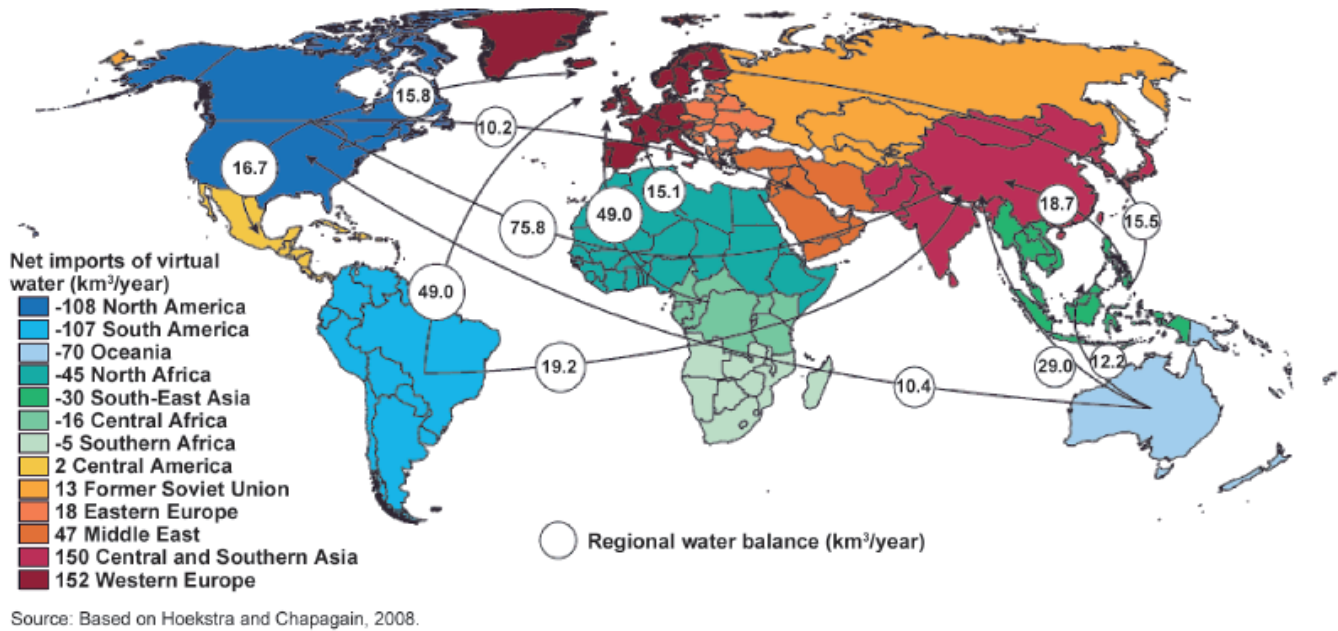


Fig. 2. Regional virtual water balance exchanged annually through agricultural production between 1997 and 2001 (WWDR3, 2009).

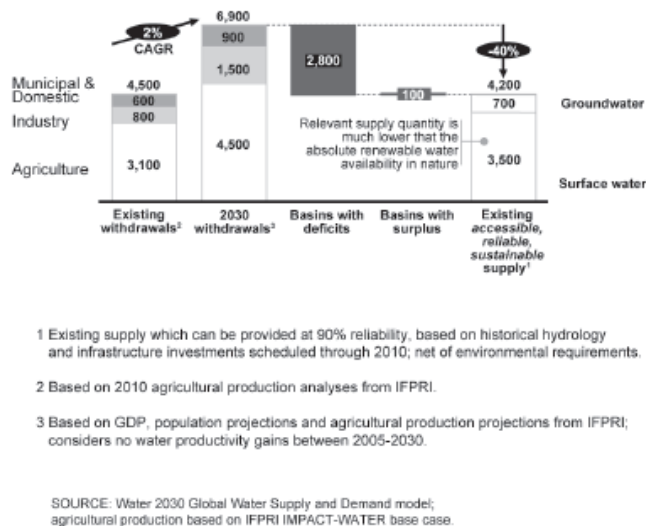


Fig. 3. Aggregated global gap between existing reliable supply (1), and water withdrawals for 2030 (assuming no efficiency gains). Figures in km³.

- The reports themselves acknowledge the significant lack of data for the indicators they present, which also increases over recent years. Few countries actually know how much water they are using, what it is used for, the quantity and quality of water available, and the amount that can be withdrawn without serious environmental consequences, or the amount being invested in water management and hydraulic infrastructure.
- In all the reports it stands out that water resources are distributed in a very irregular manner, as much spatially as temporally, however average figures are used and there are, generally, no reliable studies on the temporal variability of resources.
- It is noted that the water cycle and demand for water can be seriously affected by climate change, thereby increasing the unknowns.

- It is quite rightly pointed out that both demographic change (in the number of inhabitants and where they live) and standards of living and ways of life also cause significant shifts in water demand.
- And, finally, one has to remember that water accounts are fixed, the largest consumer of water is irrigation for food production (and now also biofuels) and the place of production does not always coincide with the place of consumption (Fig. 2)."

"Must we therefore desist in our task of answering the query posed to us?"

"Not at all, my dear teacher."

"I agree, my respected Socrates. When there are strategic decisions to be made, the facts are not always available; however, in spite of these doubts, maybe the worst decision would be to wait for events to take their course with no action on our behalf. With we are dealing with such an essential topic, and when all available data shows us that problems do exist, major ones even, one cannot simply look the other way and adopt an amateur position."

"And what would those major problems be, Augustus Caesar?"

"I would summarise them thusly:

- The basic human needs for access to a safe water supply and basic sanitation are a long way from being met, as shown in the graph attached (Fig. 3). In the Roman Empire we were already carefully planning how to establish new settlements in the territories where the Empire was expanding, and we would attend to water supply needs and take care of our cities' sanitation, to avoid the attendant health and sanitary problems. Frankly I am amazed, shocked even, that, given the level of tech-

nical advances and capabilities available to humanity today, the provision of drinking water and sanitation of sewage has become such a serious problem. It is inexplicable that the lack of something so basic should be still be causing such poverty, health problems and even a significant number of deaths. The majority of demographic growth expected over the next few decades will be concentrated in developing countries (90% of the extra 3 billion people by 2050), exactly where the lowest water supply and sanitation coverage is found.

- **Food crisis:** The relentless increase in demand for agricultural products to meet the needs of a growing population is still the largest vector in water usage. Steady economic growth and changes in lifestyle, particularly in emerging markets, have led to a more varied diet, including meat and dairy products, which puts additional pressure on water resources. The recent food crisis is a warning of what is to come if nothing is done. Irrigated agriculture, which the WWDR3 says withdrew 2,700 km³ in 2000, now in 2010 withdraws⁴ approximately 3,100 km³ (71% of current present water withdrawal), and, with no efficiency gains, will increase to 4,500 km³ by 2030 (which will represent 65% of global water use). Therefore, the challenge of water is intimately linked to the provision of food and trade. The main centres of agricultural demand, also the places where the poorest farmers live, are mainly in India (forecast use for 2030: 1,195 km³), Sub-Saharan Africa (820 km³) and China (420 km³).

- **Energy crisis:** Energy is needed for water (to provide it in sufficient quantity and quality, when and where it is needed) and water is needed for energy (for its production and regulation, be it directly with hydroelectric energy (including pumped-storage hydroelectricity), or indirectly, for cooling nuclear and thermal (coal and fuel) reactors, and also for biofuel production). In recent times, forecasts on dwindling fossil fuel reserves have led to a significant increase in the price of energy.

The majority of water withdrawals by industry (20% of total water withdrawals in the world) is for generating power, but one must remember that the majority of this water (about 95%) returns to water systems.

If present energy policies continue unchanged, the global demand for energy is expected to grow, by at least 55% by 2030 according to estimates from the International Energy Agency. China and India alone will make up 45% of the forecast growth and all developing countries together will represent 74% of the demand. Once again, economic growth and changing lifestyle patterns will be decisive factors in this area. Hydroelectric energy and other renewable energy sources are predicted to increase by 60% between 2000 and 2030. Future development of hydroelectric energy will be limit-

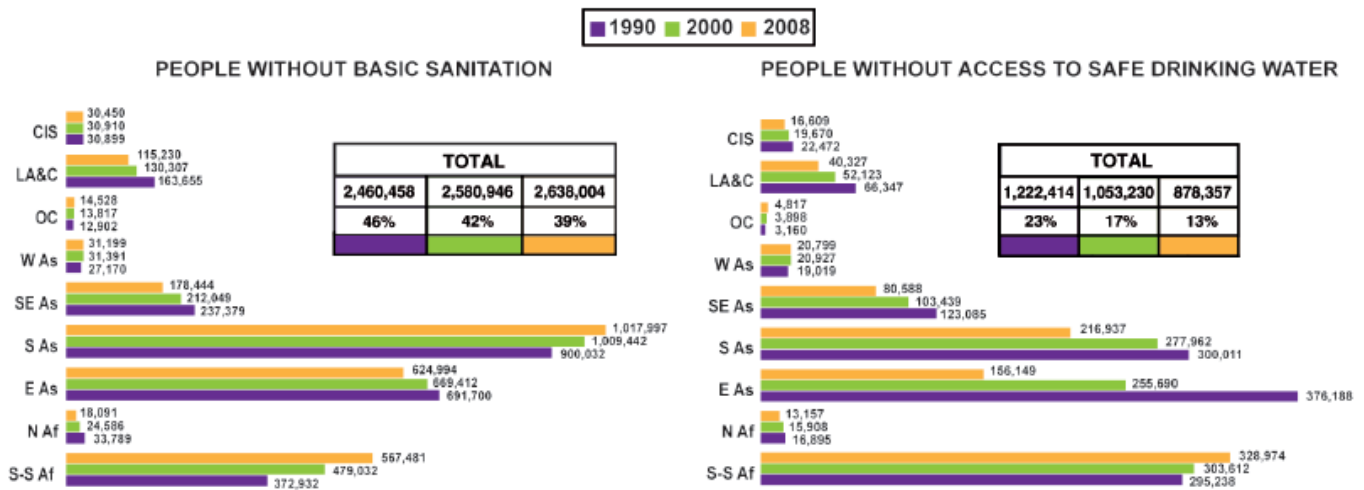
ed principally by two factors: Available space that meets the geophysical requirements for new production facilities (already very limited in areas like the United States, Western Europe and Australia) and the ability to finance them (the main restriction in developing countries including the majority of Africa). Added to this is pressure from environmental groups who are opposed to the construction of new dams.

Since renewable energy alone will not be enough to absorb such a significant increase in energy demand by 2030, extraction of fossil fuels and nuclear energy development is expected to continue increasing. This will also impact water resources and the environment. On average, coal uses 2 cubic metres of water to generate one MWh of electricity; nuclear reactors average 2.5 m³/MWh and oil, 4 m³/MWh. And bioenergy, normally from cultivated crops, reduces CO₂ emissions into the atmosphere, but is not free from problems since it competes with food crops and thus increases the price of certain food products, it also requires more water, and causes other environmental impacts.

- **Financial crisis:** In a setting where the global economy has been shaken by a recent financial crisis, this is an aspect we should not overlook. Although water is often described as a gift from nature, its management and usage for a wide variety of human and ecological needs entails financial costs, which are often widely ignored, undervalued or under-served, which leads to serious problems in the long term. All water-related activities, be they structural (waterworks) or not (water standards, planning, data collection, education and training...), require capital to be carried out. Having sufficient funds and will to invest in water management and infrastructure has become one of the major determining factors in making water of sufficient quantity and quality available. Governments still only have three basic ways at their disposition for financing water resource development: tariffs, taxes and aid from international cooperation or philanthropic organisations. To close the remaining gap between supply and demand, substantial additional investment in infrastructure is needed, which some estimate at more than four times the current spending. Also highly relevant is the figure allocated to existing water infrastructure, as the infrastructure is getting old and becoming obsolescent especially in developed countries.
- **Climate change, natural disasters:** Climate change affects all regions, but in different ways (some face rising sea levels, while others face precipitation concentration). Climate change exacerbates all the problems already mentioned, and also, could significantly increase the risk of damage associated with floods and droughts,



LACK OF WATER SUPPLY AND SANITATION COVERAGE BY WORLD REGION



LACK OF COVERAGE IN 2008		
	SANITATION	WATER SUPPLY
CIS Commonwealth of Independent States	11%	6%
LA&C Latin America and Caribbean	20%	7%
OC Oceania	47%	50%
W As West Asia	15%	10%
SE As South-East Asia	31%	14%
S As Southern Asia	64%	13%
E As East Asia	44%	11%
N Af Northern Africa	11%	8%
S-S Af Sub-Saharan Africa	69%	40%

SOURCE: WHO, UNICEF, "PROGRESS ON SANITATION AND DRINKING WATER: 2010 UPDATE"

Fig. 4. The long sought-after goal of providing clean water and basic sanitation for all is far from being achieved.

reversing the economic development and progress made in many parts of the world, including the least developed countries (the most vulnerable). They bring about not only economic losses, which can run to billions of dollars or Euros, but also significant loss of human lives and worsening poverty.

- In some places, pressure on the environment has passed the point of no return. The amount of freshwater available on Earth is finite and its distribution varies considerably, dictated mainly by freeze-thaw cycles and fluctuations in precipitation, runoff and evapotranspiration rates. This natural situation has been altered by human activity, which has become a primary agent in exerting pressure on our planet's water systems. Pressures, generally arising from human development and economic growth (in search of ever higher standards of living), clash with the planet's fragile ecosystems, which need water to survive. All this makes water unique amongst the Earth's natural resources and in the first environmental agent. Pressures are a result of five external vector-agent groups: Demographic, economic, technological, social and government (and exacerbated by climate change). These are all areas where agents in the water sector (managers and users) have little power to change."

"Anything to add, Plato, from your personal analysis?"
 "For my part, I would like to summarise what Caesar Augustus has said so well, and note that by 2030, under average economic growth conditions, and assuming no improvements in efficiency, global water requirements will increase from their present level of 4,500 km³ to 6,900 km³. This would be 40% more than the amount of affordable and dependable water available today (3,500 km³ of surface water, 700 km³ of underground water, including returning flows and taking into account that a percentage should be reserved for the needs of the environment, which could be said to be around 25%) (Fig. 4). Spatio-temporal irregularities and lack of infrastructure, along with degradation of the quality of the resource, make the actual figure just over 10% of the total amount of renewable freshwater available for use when, where and as needed. This global figure, that separates future demand from guaranteed water supply, is the result of a large number of local gaps, some of which present an even worse situation: One third of the population, mainly living in developing countries, will live in water basins where this shortfall is greater than 50%. The amount of supply that is accessible, dependable and sustainable from an environmental viewpoint (a much lower figure than the actual total of water

available in nature) is the figure that really matters in measuring the water challenge. Today, man already has sufficient technology to produce drinking water from saltwater (and sea water resources are, for our purposes, almost infinite: We are talking about 1.4 billion km³). However, unresolved problems remain of its high cost and effects on the environment, mainly due to the amount of energy needed for the process, and for transporting desalinated water to its destination. And with the need to preserve our water resources and their ecosystems, though we might not yet be able to quantify, or even, qualify them, we already have a synthetic visualisation of the existing problem.

I would like to add some background thoughts on the origin of these problems, and the difficulty of the struggle to overcome them. Let us return to the dividing line: It is impossible that the landscape is merely as the photograph represents it. If we wish to nobly and loyally fulfil our undertaking, we must go beyond our own imaginations and beliefs, rather than mere descriptions of what we perceive (which would make any answer we gave nothing but an opinion), we must apply our understanding and intelligence, operations which will allow us to obtain the knowledge asked of us.

For a long time, objectives have been suggested for avoiding water problems: In successive international and global summits and conferences since Stockholm 1972, there have been calls for us to be more careful in our actions on this planet, to take environmental consequences into account and promote integrated management of our water resources. The 80's were declared the International Drinking Water Supply and Sanitation Decade with the goal that by 1990 everyone in the world would have their needs met... But, incredible though it may seem, after 38 years of summits, conferences and decades, no solutions have been found and the goals have not been reached.”

“So, what is the underlying issue preventing us from arriving at a satisfactory solution?”

“I think if we dig a little deeper we will find a reason: Man's selfishness and ambition. Water is essential for life and equally essential for development. Man relies on available water to grow and reach a privileged position, barely assuming a responsible stance on use of the resource, and brings about what has been termed a 'tragedy of the commons', which manifests itself in the inevitable degradation of the environment caused when individuals use a shared, scarce resource. Those who restrict their own use of common resources may consider that they will incur economic losses compared to those who continue to use the resources with no restrictions. Thus, everyone selfishly makes use of the resource without caring about the possible degradation of the environment. Lack of solidarity towards others also occurs when, collectively, scarce resources are



Fig. 5. Storing water when there is surplus in order to supply it when needed is the key to meeting demand and creating a favourable environment for development. The Compuerto dam and reservoir, Carrión river, Spain.



Photo: Carlos Blázquez

Fig. 6. International cooperation and aid is needed to solve the world's water problems. The Volunteers' Footbridge, Expo Zaragoza 2008, Ebro river, Spain.

controlled by certain societies or states as a tool for maintaining power over others. It seems that we are far from the maxim I coined, 'May I do to others as I would that they should do unto me.' Maybe this explains the lack of generous global action aimed at sharing the development and benefits from making good use of the resource. While it is true there has been something of a renaissance in aid and international water cooperation efforts; there is still not enough (between 5 and 6 billion dollars per year, about 5% of total bilateral and multilateral support).



Added to this, although the studies may be global, there are still borders and blocks, and also mistrust and fear between nations and peoples. Because of this, geopolitical considerations come into play and decisions are adopted which parcel out global action, introducing inefficiencies, mainly due to fear of not having enough supply for the first world. No one wants the resource to be in the hands of totalitarian or fundamentalist regimes... nor in the hands of the nearest neighbours who are seen as competing rivals in the market. Could it be that we still believe water falls from the sky and has no limits?

On the other hand, action on water matters is slow, and the blame lies with the lack of long-term policies, which are necessary to recover water investments. Politicians look to gain votes by implementing investments which produce visible short-term results. However investing in water is profitable: All the organisations and studies state that investment in water, both socially and economically, is one of the most profitable. According to the WHO, apart from the unquestionable improvement to the lives of millions of people (providing clean drinking water is the key *par excellence* to keeping a population healthy), there is also a potential economic benefit of 3-34 dollars for every dollar invested in sanitation and drinking water. In the United States, publications talk of return on water investment being in the order of 1 to 6 (cost to benefit) just though reduction in damage from extreme weather phenomena. Spanish statistics show that for every cubic metre of water used, an average output of €27 is generated (for an average cost of less than one euro).

On the other hand, in the case of water, especially in planning and integrated management, public participation is necessary and desirable. It brings value, judgement and viability to everything we have to do, promote and agree upon in order to reach the goals adopted by our society. Public participation ultimately guides us towards making a positive impact (beyond the hackneyed term 'sustainable



Fig. 7. Middle and lower courses of rivers are suitable for fertile plains; however they are at risk of flooding, which has to be managed. Middle stretch of the Ebro river, Spain.

development') on mankind's present, and future, quality of life in our natural, geographical surroundings (and corresponding watershed). It should not just be a mere formality arising from fashion or regulatory imposition."

"I only know that I know nothing, however after hearing all that I wonder what lessons can be learnt from recent history. And maybe Caesar could enlighten us with another issue."

"Noble Socrates, I am a man of action and my capacity for reflection is not as great as yours, but yes, I would like to raise a few points that might be relevant.

Firstly, it is worth noting that mankind has successfully overcome similar problems throughout history, and has moved forward, in most cases thanks to technological advances. The advances and inventions brought about by mankind's intelligence enabled our planet to host 150 million of us with no problems at the time my Empire. And if the 20th Century began with a global population of 1.6 billion, and in 1960 they passed the 3 billion mark and by the end of the century had 6 billion... With this population increase since the beginning of the century (almost four times) came a corresponding six-fold increase in water supply. This development was only made possible thanks to hydraulic infrastructure being put into place, and managing all aspects of its usage.

Secondly, I would like to mention the need for water planning. Given the competition for the use of available water; given the need to optimise the allocation and reservation of these resources and for optimising global profits; given the need to protect and regenerate water resources and their ecosystems; and bearing in mind that in the long term all necessary actions will need effective ideas, proposals, agreements, designs, construction and commissioning; if anything ever justified a complete planning process it is the field of water. As much within the framework of planned or mixed economies as in free market economies.

Thirdly, one should highlight the need for integrated management of water resources and their associated land or territories. For quite some time it has been internationally accepted and there has been global consensus that effectively implemented integrated water management is the most efficient and fair manner (within a context of sustainable development) for managing the world's limited water resources and to thus meeting their conflicting demands. Integrated water resource management involves many concepts: Management of water basins, including transnational ones, integration of surface and underground water, of supply and demand, of the different types of usage themselves, and of environmental needs, territorial planning, integration of different management levels...

There is still a lot to do in putting environmental damage and its real causes into objective terms. The same goes for deciding which are the most opportune measures

to regenerate water ecosystems. Up till now, the most effective measure has been implementing ecological water flow standards for rivers, avoiding overexploitation of aquifers, the responsible and reasonable use of pesticides and fertilisers in agriculture, and sanitation and treatment of urban and industrial wastewater.

Another important issue is the need to involve water users and society. Recent Nobel laureate in economics, Ostrom (1990) proposes a solution to the dilemma of the commons: involving users themselves in the design of rules about its ownership and/or provision, compliance, monitoring and sanctions. She believes that in the case of common goods, it is useful to consider participatory strategies through which users are consulted and even asked to partner with authorities in managing said goods (Fig. 08). It is highly significant that amongst the experiences and real cases studied by Ostrom is irrigation in the traditional fields of crops in Valencia.

In addition, there is also the need for a clear regulatory framework and that water resources be considered a common-pool resource, protected by public authorities, although open to private initiatives. So that they can effectively allocate resources, protect it and promote its efficient use, and help maintain water quality.”

“Any other observations, Plato?”

“Well, yes, one more. An important one. The need for professionals and hydraulic civil engineers to lead the process and complete it successfully. Sometimes it seems that engineering is sidelined, despite it being clear from history that engineering has brought about the developmental success the 20th Century. Another matter is the unforeseen environmental side-effects which were not managed in time (that indeed require action, and this is happening); however this matter should not be exaggerated nor cancel out all the positives. ‘Sailing and curing are not things that everyone is qualified to practice by nature’... well the same goes for water, the construction needed to make use of water, its subsequent operation and maintenance, planning and resource management, simulation models, operation and optimisation, data collection (quantitative and qualitative), regulation, driving and transport, water purification and wastewater treatment, flood abatement, flood zoning, dam security, special planning for droughts... are all professional activities requiring specialist training and knowledge that should only be entrusted to people professionally trained to do them. None of this list can be carried out successfully unless the respective duties are carried out by qualified civil engineers, who can also propose ideas for more efficient performance from a holistic point of view. But to do this, it is not enough for these professionals to stay at the forefront of knowledge and acquire new skills, they must also make themselves heard and get

involved in political and social processes to spread their message and become relevant in public dialogue.”

“Many thanks, good sirs. Here I would remind you of my opinion that ‘There is only one good, knowledge, and one evil, ignorance.’ And since ‘knowledge is only useful when it makes us better’, allow me to express my enthusiastic consideration of what you have said. We are scheduled for another meeting in which we will move to summarising our recommendations to those who have entrusted us with this task. Your honour, I believe we are now ready to embark on the final phase of our mission.”

Recommendations

“At this juncture, could we move on to offering some conclusions? I am noting and proposing to you a series of priority subjects, taken from your assessments and respective commentaries. Plato, Augustus Caesar, I hope that afterwards you will provide your thoughts and clarifications with respect to the following:

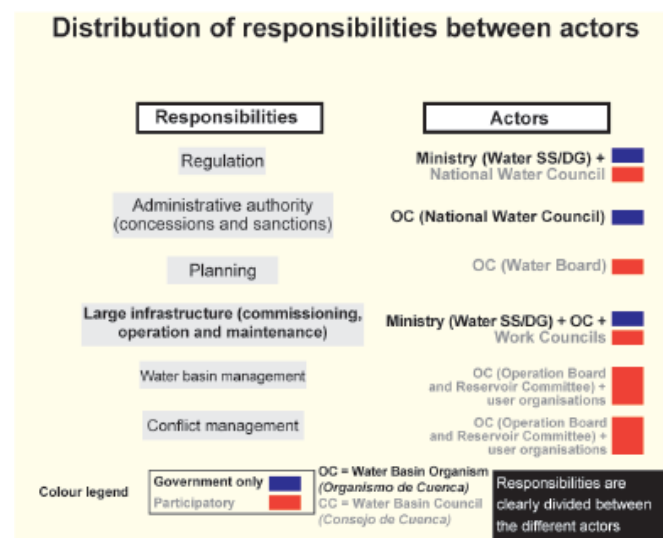


Fig. 08. The scope of participation and governance should be properly adapted according to each territory and also each matter. Here we show the Spanish system of water management. Prepared by: Salvador Parrado and Tomás A. Sancho.



Photo: Carlos Blázquez

Fig. 9. Supplying cities requires hydraulic works which can sometimes turn out to be emblematic. The Noain aqueduct, Navarra, Spain.





Fig. 10. The incorporation of rivers into cities provides a better quality of life for their inhabitants. Ebro river in Zaragoza, Spain.

1st) Water should be considered and recognised as a human right.

“Yes, in that it is a prerequisite for life. This value (40 to 60 litres per person per day) is a challenge for humanity that requires everyone’s involvement, and which should be driven and guaranteed by public powers, and should not be conditional on the users’ ability to pay.”

“Both water supply and sanitation must be unrestrictedly guaranteed (water security), both in rural and urban areas, in an effective manner.”

“And this demand takes priority even over environmental considerations. In this sense one cannot appeal to solidarity between generations.”

“2nd) For the rest, to seek sustainable development, interventions should be subject to integrated planning and water resource management.”

“Yes, and this must translate into concrete concepts. Future scenarios should be anticipated, measures must be sought and defined to ensure supply satisfies demand, which promote socioeconomic development, balanced territorial distribution, and improvement and conservation of water ecosystems. Also, combining action on surface and underground water, and respecting the integral water cycle.”

“Meeting the demands should be prioritised according to the type and segments of demand, which can need different levels of guarantee to meet their demands, which can lead to graduation and acceptance of trade in periods of drought in order to improve water security for the uses that need it most (e.g. supply versus irrigation, or forestry versus crops).”

“Water accounting must be improved, both for the evaluation of resources and for other indicators. The water footprint for each water basin/country/region must be calculated.”

“Territorial planning must be coordinated, in order to keep pace with resources available and to mitigate the effects of natural disasters.”

“It must serve the needs of man and society, especially coordinated correctly with food and energy.”

“It should not be misused to restrict people’s freedom to settlement and life patterns, but rather should provide information to understand the consequences of decisions on mankind and society.”

“Planning should be a bottom-up process where the priority role of water users is respected, who must work together especially on management and resolution of any conflicts or problems that arise, and also on the financing of the measures adopted.”

“To achieve this, planning studies and management measures should be developed by qualified professionals, with a holistic vision and interdisciplinary teams, but led by those who have been specifically trained for it: Hydraulic civil engineers.”

“It must be based on the natural geographical frame of the water basin (and shared aquifers), and thus overcome the different political and administrative barriers.”

“3rd) Water should be the number one item on governments’ political agendas in order to foster national and international action.”

“A lot is said and little done...”

“We cannot look the other way when millions of people’s basic water and sanitation needs are not being met.”

“And water is a factor which links the food crisis, the energy crisis and the financial crisis. Furthermore, the major impacts of climate change on mankind and the environment occur through water. In a scenario of growing demand and pressure on water resources and their ecosystems, we cannot, and we must not, waste any time.”

“Today, when technology can provide us with water from the sea and energy from the sun, we will be talking about prices, but there is no room for fearing the future. The technologies, practices and management approaches needed to address water security problems should be identified and supported by research and development. Scientific advances and technological improvements must be encouraged.”

“Water must be considered a shared, public good, since it is deeply related with the public interest, its regulation prevents it being appropriated by those with most economic resources, and also prevents the deterioration of water ecosystems.”

“Water has to be a top-level policy in order to seek water security and international solidarity through the strategic use of the most precious resource on Earth.”

“Governments should review the need for social participation, education and awareness on the topic of water security.”

“Action should be framed within integrated water resource management concepts. Both better management of the supply and better management of demand are two sides of the same, necessary solution to the problems.”

“Public powers have to be the guarantors that decisions adopted during planning are effectively carried out so they do not remain mere political intentions.”

“4th) Investment in waterworks should be increased.”

“Humanity will not be able to avoid future crises if investment is not made in waterworks. Investment should be at such a level that there is enough water to satisfy human rights and supply and promote sustainable development. It requires on one hand, an increase in the amount of resources available (through storage, treatment, transport, or desalination, reclamation and reuse), and on the other hand, to ensure its efficient usage and return to the water system in good enough condition to protect the quality of the resource in sanitation and water treatment.”

“Although it has been shown that they are investments which have large returns in the medium to long term, with the economic resources currently allocated the problems are far from being solved.”

“They are needed in both developed countries (where maintenance and improvements to aging hydraulic works have been neglected) and in developing countries (whose growth will be conditional on the availability of water for primary, secondary and tertiary processes).”

“The development of waterworks will not solve everything by itself, since it is important that institutional capacity is developed in each country and that stakeholders are dedicated at all levels to making it work.”

“Mechanisms for financial investment along with collaboration between the private and public sector must be encouraged and promoted. The latter might, under public control, with a reliable and stable regulatory framework, provide both greater efficiency and management capacity, along with the resources and means to shorten the time it takes to solve problems.”

“The economics of water should help in the correct operation and selection of activities, ideally so that ‘water finances water’, which should be directed to cost recovery and apply the principle of ‘he who pollutes pays’, in such a way that the demand for water is contained and environmental costs are internalised by those who enjoy exclusive use of water for their own economic benefit. These considerations should not be applied to, or restrict, actions for ensuring water as a human right and reaching a minimum level of social development in disadvantaged areas.”

“5th) A World Water Agency must be established, which would organise and drive global action on water matters. It would facilitate essential tasks for collaboration between developing and developed countries to support both their realities and to overcome looming global and local crises.”

“The relationship between water, food security and energy security in different parts of the world should be evaluated in order to achieve the optimal balance of different national policies.”

“This forms part of the international search for peace, justice and equality between countries, elements which inspired the establishment of the League of Nations. The importance of water security should be an essential component in formulating international policy.”

“The World Water Agency should impose order and thus overcome barriers in the field of water and act in a unified, ethical manner, fairly and justly, in line with the statements proposed in the Zaragoza Charter.”

“As citizens of the world, we are grateful for the confidence shown in us, conscious of the fact that ‘opportunity is the exact moment when to receive or do something’, and at the risk of being mistaken, and believing that ‘a man who risks nothing for his ideas, either has worthless ideas or is a worthless man’, we have risen to the challenge asked of us. These, then, are our conclusions and recommendations which, of course, subject to any better-founded opinion, we hope and wish will help guide the current generation at its water crossroads.” □

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Notes

1. The United Nations World Water Development Report, Report 3, *Water in a changing World*, published in English 2009 by UN-Water (the interagency of the United Nations which coordinates the various entities that deal with freshwater), prepared under the leadership of UNESCO in the framework of the World Water Assessment Programme (WWAP).
2. The 5th World Water Forum, organised by the Turkish Government and the World Water Council, took place under the theme “Bridging divides for water” in Istanbul between the 16th and 22nd of March, 2009. More than 25,000 people attended and contributed seven regional papers and dozens of issue papers.
3. The International Expo “Water and Sustainable Development” took place in the months of June and September, 2008 in the city of Zaragoza, originally named *Cesaraugusta* by the Romans in the time of Emperor Augustus Caesar, more than 2,000 years ago. It could be considered the Spanish capital of water issues. The Expo hosted the Water Tribunal, during which, for 93 days, more than 2,000 experts from all over the world took part in the biggest international event ever on water and sustainable development.
4. Here and in the following paragraphs, we base ourselves on a recent 2009 report, “Charting our Water Future”, drawn up by the 2030 Water Resources Group, a consortium of (generally private) companies from various major sectors of the world economy.





The Spanish experience in water planning and management by water basins

Francisco Cabezas Calvo-Rubio

KEYWORDS
WATER PLANNING
WATER MANAGEMENT
BASIN AGENCIES
WATER BASINS

Introduction

Water policy can be viewed, in a broad sense, as the collection of all actions undertaken by public authorities on water resources, as much from a regulatory standpoint, as from the standpoint of water's use, usage priorities, protection, financing, infrastructure, etc.

Historically, this collection of actions has derived from the collective circumstances and preferences of the time, not explicitly expressed and, often, not even specifically identified. So, for example, at the dawn of the 20th century, Spanish *water policy* basically meant Spanish agricultural policy and, given the importance of the agricultural sector in the Spanish economy, economic policy. There was no need for an express statement of these preferences because they were considered obvious, and the obvious did not need to be proven.

The passage of time and progressive social and economic development have led to greater problems and more complex correlations. It has become increasingly necessary for public preferences and objectives regarding water to be explicit, valued, prioritized and connected with other public policies with which water has close relations. Such is the case, for example, with agricultural or energy policy.

Within this ideological framework, water planning has emerged as a useful technical/legal instrument for rationalizing and expressing water policy and its management criteria. Thus planning was developed in Spain beginning in the middle of the last century, with the 1985 Water Act definitively giving it pre-eminent status which would later be widely ratified by the European Water Framework Directive. This Directive adopts the model for planning and basin management as one of its conceptual foundations, up till now considered extravagant by many countries, but fully accepted in Spain since ancient times.

Certainly, water planning is neither a new technique nor is it the only instrument through which water policies can be expressed; however, recent legal regulation has underlined its fundamental, pre-eminent nature and given these precepts a normative quality and a formal relevancy which, until then, had been lacking.

The Spanish experience in water planning and management illustrates these ideas well and allows us to draw conclusions that may be of interest and use to everyone.

Continuity and change in the planning process

Although *planning*, when taken to mean *rationalisation*, is as old as the usage of water itself, in Spain, the first systematic attempts to formulate and anticipate a water problem, to analyse alternatives and propose a course of action when faced with the need to prioritise actions regarding limited resources, date back to the second half of the 19th century.

From this era come plans like those of Gómez Ortega, Lizárraga and Churruca (1866) for the Júcar River flood defences, or those of García and Gaztelu (1886) for the Segura River's defences where the first hydrological surveys were developed, fundamental, pioneering works on the collection of river basin data, river mapping and incipient water planning, all carried out by the hydrological divisions of the Ministry for Development.

Later, at the beginning of the 20th century and in a long historic series, the first work plans were drawn up, starting with the National Hydraulic Works Plan in 1902 and its subsequent revisions in 1906, 1909, 1916 and 1922, and later followed by the Plan of Hydraulic Works in 1933, the General Plan of Public Works in 1940 and its successive adaptations, the First and Second Plans for

Economic and Social Development in the 1960s and 70s, and the hydrological plans of 1993, 1998 and 2000, etc.

There has been, therefore, and it is important to highlight this, ongoing planning activity and strong historical continuity in the creation of plans which have been conceived and maintained in Spain over many years, crossing very different economic, political and social situations. At each point in time, perspectives and priorities differed, but there has always been recognition of a national problem associated with the irregularity of the water regime (much more pronounced than in other European countries), and agreement on the need for public intervention to tackle its negative consequences for the country as a whole. The process of continuity and change has been clear and manifest.

Until the middle of the last century, the objectives of major public actions taken over water, both regulatory and regarding infrastructure, have been fundamentally social (developing irrigation to combat famine and poverty in the country), and economic (providing water resources to meet socioeconomic demands and to defend against flood damage). Since the middle of the last century, added to these concerns have been the preservation of water quality, the fight against pollution and, more recently, water's ecological dimension and the need for a systematic and integrated viewpoint.

All these ideas are present, albeit in a preliminary way, in the formation of the Basin Agencies (*Confederaciones Hidrográficas*), pioneering organizations which, geographically based on water basins, were conceived in the 1920s with the goal of providing an organizational and institutional structure capable of addressing water problems from new, broader perspectives, and overcoming the localisms associated with provincial territorial organization that existed at the time.

The following section briefly outlines some of the more significant milestones brought about by this historic evolution.

Plans from the 20th century and the current situation

Without going into 19th century history, as we have already noted, in the early 20th century, *water policy* for Spain basically meant agricultural policy. The General Plan of Irrigation Canals and Reservoirs, or Gasset Plan, of 1902, was the first systematic proposal for water action at a national level, it listed possible actions to undertake.

The progressive increase in regulation of watercourses and water usage, for irrigation and supply and even for hydroelectric power generation – already a strong and important need at the beginning of the century – led to increasing rationality and integration in water-resource-related actions. One example of this new focus is the creation, in 1926, of the Ebro Hydrographic Confederation, one of whose main objectives was to optimise the usage of water

so as to maximise the “economic potential” of the hydrographic territories. Without doubt, the concept of using a flowing water basin as the basic unit for developing water resource management, over and above political boundaries, was a pioneering, integrated approach to solving problems.

No longer was it a matter of reacting to local pressures in a punctual and uncoordinated manner, but instead it meant promoting balanced coexistence, at a broad, regional level, between the different sectors such as: irrigation, hydroelectric energy production, water supply and even river transportation, all competing for water usage. Also, the increasing regulation of rivers, especially through state-sponsored activities, made it advisable to find ways to reconcile state and private interests. A clear example of this is the initial organisation of the basin agencies, which were very participatory, and which consisted of an assembly (with representatives from the state, users and other organisations like chambers of commerce, banks, etc.), a government board (named by the assembly) and two executive committees. From the very beginning, users' active participation proved necessary for the proper running of the water administration.

A significant advance in the trend towards integrated water use took place in the 1930s with 1933 National Plan of Hydraulic Works drafted by Manuel Lorenzo Pardo, with the collaboration of Clemente Sáenz, Ángel Arrué and Joaquín Ximénez de Embún. In this fundamental Plan, on which numerous studies and exegeses have been written, a reasonably collective and structured approach was formulated regarding national water problems based on analysis by water basin and with the goal of avoiding local and homogenizing temptations. Moreover, it did not limit itself to considering purely hydrological issues, but also geographical, climatic, economic, etc. ones. These approaches were possible because more complete data and studies were available compared to the beginning of the century, thanks both to work by the technical services of the Ministry itself, and also to some excellent monographic works that had been carried out on geology, hydrology, etc., which allowed them to know much more about the contributions, demands and characteristics of the Spanish rivers.

The conclusion reached by Lorenzo Pardo, the man responsible for drafting the Plan, and for analysing the data, was that Spain has a geographical and economic reality marked by two opposing imbalances. The first imbalance is hydrological and consists of the strong inequality between the volumes of water available in the Atlantic and Mediterranean zones. The second indicates that the Mediterranean zone (the one with less water) has better possibilities for irrigation, the main economic objective underpinning its planning considerations. The logical conclusion reached by the drafters of the Plan, a consequence of their objective of maximizing national income, was that, given the water



shortage suffered by the Mediterranean zone, water could be transported from Atlantic basins for use in the Mediterranean area, through works planned and implemented by the state as the highest representative of general interest.

On the other hand, the 1933 Plan considered, following the same line of thought that created the Ebro Hydrographic Confederation, that to overcome the disorganised exploitation of rivers, “public and private interests needed to be combined” in each basin, applying rationality criteria. This gave rise to the creation of other basin agencies based on the administrative model defined when the agency for the Ebro River was created, but adapted to the peculiarities of each territory. Thus the foundation was laid to deal with a historic problem, furthermore, new and emerging uses, such as hydroelectricity, which had conflicts of interests with irrigation, could now be channelled through these new organisations, as indeed happened on many occasions.

After the Spanish Civil War, in 1940 Alfonso Peña Boeuf’s General Plan of Public Works was approved, which explicitly cited, when referring to hydraulic works, what had been foreseen and studied in Lorenzo Pardo’s Plan; however Spain’s socio-economic situation the 1940s again recommended that social actions took priority over economic ones. That is, the state invests in hydraulic works despite knowing the difficulties future users of regulated water would face in collaborating not just on their funding, but also on covering operation and maintenance costs. Note that there was continuity in the technical approaches despite a huge change, not just of government, but of a whole political regime.

By mid-century, the expected increases in agricultural production arrived as predicted and were absorbed by the nation’s domestic consumption. Just as during the time of Joaquín Costa, irrigation was thought to be doubly effective: firstly from a social viewpoint, but also, without doubt or need for analysis, from the economic point of view, especially considering the export opportunities which were already being predicted.

Starting in the 1940s and especially in the 1950s and 60s, there was strong development in hydraulic work construction, mainly reservoirs and wells, as a result of the preferential treatment from the state of regulatory works for irrigation, and large increases in hydroelectric projects, from private initiatives, and the development and usage of underground water by individuals.

As a consequence of these multiple causes, water changed from being a regulated resource to a natural one, such that, halfway through the 1960s the Second Development Plan was drafted, where the “Integrated Use” of resources was stated as a necessity since it was believed that Spain had now entered a phase of water maturity (a phase considered to have been reached when demand surpasses roughly 50% of natural resources).



Fig. 1. Diagram of diversion from the 1933 Plan.

In this development context, with secular famines having been overcome, it once again made sense to organise the state’s actions using planning criteria such as socio-economic profitability, cost contribution by the beneficiaries, capacity to adapt to changes, etc. These criteria, which were already starting to incorporate new ideas on water planning, spread to the main developed countries, and led to a reduction in the development of large hydraulic works (reservoirs and canals) in water plans, as the goals previously sought were gradually being achieved, and indeed, with time were all reached.

The aspiration of developing infrastructure for regulation and transportation has always been a historical constant in Spain, which is easily understandable given the marked irregularity of the water regime and the need to provide a stable and secure water supply, a highly-prized, essential resource for development and social welfare. Today it could be said that the majority of these great actions have already been developed with the occasional significant exception like definitive compliance, to the required degree, with the Ebro River regulations, or the problems of drought in the east and southeast, which still lack a stable and permanent solution.

More recently, the most significant and immediate precedent, that is similar in concept to the present plan, is the Royal Decree 3029/1979, of 7th of December, which regulated the completion of “preliminary studies for water

planning”, regarded as a cardinal instrument in new water policy. According to this Royal Decree, such preliminary studies should include: an inventory of water resources with present and future availability levels, both quantitative and qualitative, forecasts for the usage of this available water, forecast changes in demand for water, and the management of resources and ideal works needed to meet this demand. Also study was required of the administrative measures needed for development along with the order of priority for implementing infrastructure projects.

This Royal Decree, short in length, but of great importance during its term, for the first time extended the regulation of water use throughout the entire national territory and established that this integrated use “will be subject to Water Plans”, even when the structure and content of said future plans was not set, only that of the above-mentioned preliminary studies.

After the Royal Decree, the next critical step was the enactment of the Water Act in 1985, which institutionalised the concept of water planning, and established that water-related actions must comply with plans, and determined both the minimum contents of the plans and the procedures for their drafting and approval. Following the enactment of the Water Act and its rulings, there was a long and complex process that, after all the important work by the National Water Plan of 1993 and 1996, though ultimately unapproved themselves, concluded with the approval, between 1998 and 2001, of all basin water plans in Spain and of the 2001 National Water Plan, after almost twenty years of work and with very broad and valuable political and territorial consensus.

These plans, that were very complex to create, succeeded in creating an organisational framework for water that, in many cases, has proven effective in solving problems. Unlike past concepts, it was not just catalogues or plans for infrastructure, but management plans for water where criteria were established for allocation and reserve which enabled them to overcome, in a peaceful and orderly way, historical conflicts such as those over the Júcar River basin, the Alluvial Plains of the Segura or the Tagus diversion. They also assumed a downward revision of interbasin transfer needs, discarding the previously-raised widespread concerns and reducing their quantities to exact minimums, following strict technical, economic and administrative management criteria which had never previously been considered.

Water planning ultimately opened a path which, though undeniably imperfect, would enable them, thanks to improvements and appropriate upgrades, to progress towards a future founded on solid and agreed bases. However, in 2004 a significant obstacle on this path occurred when preliminary planning and the legal-administrative administration model it entailed was expressly rejected and

replaced with a catalogue of major desalination works and saltwater transportation projects, involving very high costs and with no administrative management mechanisms, whose final outcome is now very uncertain.

The approval process for water plans also coincided with the development and implementation of the European Water Framework Directive in 2003 which, with great environmental ambition, consecrated for good the principal of basin unity and the required use of water planning in all the European Union’s territories.

It is worth highlighting, generally, that, at the time, legal regulations for planning in Spain not only contradicted the Directive, but also included content and objectives that, in some respects, were broader than those of the Directive itself. Another matter is, obviously, the great technical difficulty in its implementation, which will no doubt be increased by the new demands and challenges of the Directive.

This is a critical point (technical complexity added to the complexity of administrative processing, with parallel procedures such as environmental assessment) which could become a burden for the planning process and, if there is no common will to make it useful and effective, turn it into a bureaucratic procedure, concerned only with following procedure and progressively distancing it from reality. One cannot lose sight of the fact that planning should be an instrument for conflict resolution, and not be another problem in itself. Some signs point in this direction and we must act with integrity and conviction to prevent this from happening.

The technical and bureaucratic complexity of present planning has required the creation of a large number of committees and task forces to develop interpretative guides and technical recommendations. The result has not always been the one hoped for and gaps, ambiguities and even contradictions have appeared which will have to be overcome in the practical development of plans. Progress has been significant; however, contrary to what one may think, truly solid and proven methodologies are still a long way off.

Take one basic example: even a matter as important as determining ecological water flow is still completely unresolved today. The first assessments made using recommended methods show results that vary so widely that the resulting figures may differ by several orders of magnitude, without any solid, scientific basis for choosing which figure to use. Trusting, as does recent Spanish legislation, their final fixation to a process of *harmonisation* (a concept presumably imported from Anglo-Saxon practices, completely alien and extravagant compared to Spanish water law) casting further doubt on the actual effectiveness that their practical application may have. Litigation in the courts will presumably be the final path for future harmonization, and only advances in scientific knowledge and



careful interpretation and application of the rules will enable real progress to be made on this important matter.

In summary, and in an attempt to leave aside and systematize the various differing historical concepts, administrative actions carried out in Spain relating to availability and use of water resources, and which could be defined as *plans*, can be classified under five basic categories, that date back to the beginning of the last century.

The first would be made up of what we could call *work plans*, which were usually made up of mere catalogues of hydraulic works, studied with technical data and the criteria of their era, with no economic assessment, and without coordination nor official budgets, which is why many failed to be implemented. Examples from this category include the Canals and Reservoirs Plan (1902), the Plan of Hydraulic Works (1909) and the Plan of Development of National Wealth (1919).

The second category, which could be termed *exploitation plans*, arises at the same time as the creation of basin agencies, whose fundamental mission objectives included the “formation of general use plans for the waters in their basins”. These plans always related to agricultural water uses and sought economic development of the affected zones through irrigation. The substance of these plans was the establishment of the usages of a particular public water flow and its usage management.

Examples of this concept include the previously-mentioned National Plan of Hydraulic Works of 1933, which was conceived as a technical/economic plan, not just for water, and which included agro-economical studies, or Peña Boeuf’s General Plan of Public Works in 1940, which regulated the construction of hydraulic works until very recently along with development plans. Tied to a single water basin, one example is the usage plan for the Segura River stated in the Decree of the 25th April, 1953, which evaluated future availability of resources and assigned them to different irrigation zones. Development plans consist of a generalisation of these concepts extended throughout the whole national territory.

A third category might fall under the heading of *water plans for specific zones* which, used to identify and resolve problems in very specific zones, usually where there is a shortage, are basically an inventory of present water usage along with a forecast of future demand and availability, seeking future adaptation to the demands and resources and not the assignment of one water course to just one usage as one sees in usage plans.

Examples include: the General Water Plan of the Lower Ebro River, established by the Order of 28th August, 1970; the Act of 30th June, 1969, which foresaw the formation of a “regional study of total water resources,” in the Balearic Islands, “which must provide a basis for the adop-

tion of measures for optimal use for current and future demand from different water-consuming uses”; or the Act from 3rd March, 1980, on urgent actions in the province of Almeria, which contemplated in its third Article the drafting of the Province of Almeria’s Integrated Water Plan.

The fourth category would be reserved for *water plans in the sense of the Water Act of 1985*, which was a true milestone for its breadth and all-encompassing nature in the history of water plans in Spain.

For the first time, unlike with previous approaches, water planning was extended, in a global and unified way, to the whole of the country, in harmony with the rest of the sectorial planning bodies and especially with general economic planning. Similarly, the development of irrigation ceases to be the primary concern and, with another historic perspective, objectives are introduced to increase water availability, to protect its quality and to rationalise its use in harmony with the environment. The policy of strict development is substituted for another which addresses quality of life and the correction of sectorial and regional imbalances. On the other hand, planning is structured hierarchically by *water basin plans and national plans*, which is a basic tool for defining state water policy.

Unlike previous plans, the new plans are not limited to a given time scale, but are permanent and continually updated, introducing for the first time the participation of users and stakeholders in the planning process, through each basin agency’s Water Council.

Lastly, the new plans are not mere technical studies, but take on more judicial relevance since they form the basis for setting other standards for water (concessions, authorizations, flow, basic infrastructure, etc.).

It is noteworthy that after the 1985 legislation, the activity of water planning evolves from being a purely technological concept (mathematical procedures for the rationalization of water use systems) to being, for the first time, a mandate of law and a formal administrative technique, clearly in tune with, and anticipating, new guidelines proposed by the European Water Framework Directive regarding what are known as river basin management plans.

The fifth and final category would be that of *water plans after the Water Framework Directive*. These plans include the contents of plans already adopted, drafted during the development of the Water Act of 1985, however they also incorporate a highly environmental focus, setting as they do the goal of achieving a good ecological state for all the water in the European Union. They also incorporate additional content of an economic type and foresee more widespread consultation and participation processes.

At the moment these plans are still at the processing stage and have yet to be approved, so there has been no real experience of them.

Some conclusions

The process described allows some interesting conclusions to be made which are also applicable to other parts of the world.

Spain has significant experience in the planning and management of water dating back a long way. This is due to the special hydroclimatic characteristics of the country, which have necessitated action since long ago to combat the irregularity of the water regime and to achieve a stable water supply in order to drive the development of socio-economic activities. The widespread development of dams for water regulation and defence, or subterranean collection wells are examples of this effort.

Water administration limited by territorial criteria, as was done historically well into the 20th century, proved ineffective in addressing problems on the scale of river basins. The ascertainment of interactions and mutual relationships between the rivers and the diversity and contrasts between competing interests led to the formation, more than a century ago, of institutions based on water basins as a unique way to bring stakeholders together and effectively manage an increasingly scarce and valuable resource.

These institutions finally integrated both administrative and water-control aspects such as the construction and exploitation of hydraulic works, and enabled the active and permanent presence of water users themselves in these institutions where they operated.

A key element in this design is previous organisation of users in communities, with broad operational, self-organisational and control capabilities that lead to natural administrative attributes as public right corporations. In situations where subterranean water is extracted, the creation of these communities is especially important, essential even, for the proper management of the resource. Experience shows that progress is not possible in solving problems like the overexploitation of aquifers with administrative measures alone, without active participation from the users themselves and from the perspective of a single hydrographic unit.

However, contrary to international trends, and its own history, today there is a trend in Spain away from basin organizations towards territorial authorities from each of the autonomous communities. This process, already experienced and overcome by history, seems to repeat itself in formulas such as the allocation of powers to provincial authorities, in the case of Andalusia, reproducing the mechanisms of political control that existed in the 19th century, whose proven inefficiency and conflicts led them to evolve into state formulas and organizations according to basins in recent Spanish water history. As an example, the transfer of functions and services of the Guadalquivir river basin from State Administration to the Andalusian government is a classic example of breaking up a basin unit for reasons of mere political expediency.

With this and other precedents, recent reforms of the autonomous statutes are heading in the direction of territorial reappropriation of water without seeming to realise the reactionary nature of the model and without a single, solid state authority to counteract this trend.

The current water planning process seems to also be subject to this trend in that, superimposed on the complexity of the bureaucracy and its contents, territorial tensions are preventing progress towards incisive solutions on the scale of large river basins. The participatory mechanisms of the autonomous communities in the basin agencies are not working as envisioned by the 1985 legislation. The general model drafted (and constitutionally validated by the fundamental Constitutional Court Ruling 227/1988) seems to falter without openly suggesting what the alternative is and how it can be approached.

From an economic perspective, the introduction water pricing has always led to more efficient usage of the resource. It is appropriate to send warnings of shortage to users, but that does not necessarily mean that all costs should be recovered through tariffs. Every case will require special treatment, since the circumstances are very different in each location and system, and the objective of achieving efficient usage, which should be pursued, does not necessarily require full cost recovery. There are even cases where full cost recovery does not introduce sufficient incentives for the efficient usage of the resource. The key is to establish a clear, transparent and common system for allocating costs and for the participation of the different agents in the financing and management of water services.

On the other hand, the advocated management unit requires a single manager. It is necessary to reconsider the structure and functions of water management and move towards autonomous organizations, strongly decentralized in their management but with common regulations, criteria and standards for operating throughout the country and under one single, solid authority that, from a global perspective, can establish criteria and make decisions from a general interest viewpoint, away from local influences and situations.

The current divisive trend should be reversed by strengthening state administration which today is weak and defenceless.

Overcoming these problems will require a reconsideration of the roles and responsibilities of the various agents involved, the setting of unambiguous positions on fundamental issues, and the establishment of the political agreements necessary to allow rigorous actions on water in the long term, inspired by general-interest criteria, efficiency and rationality, and not subject to mere ephemeral whims and local situations. □

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Water in Latin America

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Water resources and usage in Latin America The abundance of water in the region

America is the most water-rich region in the world. The Amazon contains 20% of the world's total river water, and furthermore, it has other large rivers such as the Orinoco, Paraná, Paraguay, Magdalena and San Francisco. The trans-border Guarani aquifer in Argentina, Brazil, Paraguay and Uruguay is one of the largest groundwater reserves in the world. In numbers, Latin America has 18,000 km³ of renewable water resources, 41% of the global total.

Latin America has 530 million inhabitants, 8% of the world population. It is thinly populated; its population density is less than half the world average. The region has the unusual characteristic that 75% of its population lives in cities or around them. And it has large urban centres, such as Mexico City, Sao Paulo, Buenos Aires and Rio de Janeiro, with populations of over 10 million people.

Worldwide, average water availability is 7,000 m³/person/yr. Compared with this figure, South America's 46,000 m³/person/yr is extraordinary. However, Mexico, the Caribbean and some parts of Central America have less availability. Mexico has 4,400 m³/person/yr, lower than its neighbour, the United States (10,500 m³/person/yr) but higher than Spain's (2,800 m³/person/yr).

Despite the abundance of water throughout Latin America, there are severe problems of local availability in its arid and semi-arid zones; such as the north of Mexico and Chile, some areas in Bolivia and Peru, and the north-east of Brazil.

Water uses

Pressure from different water uses on the renewable water resources of Central America and South America is very low compared to other zones in the world. Total water extractions for all uses are estimated at 261 km³, which represents 3% of its total renewable water resources. More extreme situations do exist in Mexico (17%) and the Caribbean (20%).

Globally, irrigated agriculture is the main water consumer, averaging 70% of all use, while industry takes 10% and domestic supply makes up 20%.

Water use in irrigation

In Latin America the total land area used for irrigation is 18.3 million hectares. The countries with the largest irrigated areas are: Mexico (6.3 million hectares), Brazil (2.9), Chile (1.9), Argentina (1.2) and Peru (1.2). These areas are relatively small compared to the 22.5 million hectares in the United States, a country that has more irrigable area than the rest of the American continent combined. Spain, with 3.4 million hectares (the largest irrigator in the European Union), is only surpassed by Mexico in irrigable area.

We must consider that some countries, like Argentina and Brazil, have huge expanses of crops and pastures, 100 million hectares between them, which are only irrigated by rain water, something that enables them to meet demands for plant production with hardly any irrigation infrastructure. The remaining Latin American countries account for a total of 50 million hectares (half in Mexico).

Table 1
Latin America: general and water resources statistics 2004

Country/subregion	Population	Surface area (km ²)	GDP per capita (US\$)*	Average annual precipitation 1991-1990 (km ³ /yr)	Average annual precipitation 1961-1990 (mm)	Total renewable water resources (km ³)	Availability per capita (m ³ /person/yr)
Mexico	103,795,200	1,958,200	8,144	1,472	752	457	4,405
Northern Latin America total	103,795,200	1,958,200	8,144	1,472	752	457	4,405
Costa Rica	4,061,474	51,100	6,382	150	2,926	112	27,675
El Salvador	6,657,687	21,040	3,598	36	1,725	25	3,785
Guatemala	12,628,480	108,890	2,623	217	1,996	111	8,813
Honduras	7,141,464	112,090	1,960	221	1,975	96	13,429
Nicaragua	5,604,000	130,000	1,097	311	2,392	197	35,100
Panama	3,027,812	75,520	7,155	203	2,692	148	48,880
Central Latin America total	39,120,917	498,640	3,190	1,139	2,284	690	17,638
Cuba	11,364,810	110,860		148	1,335	38	3,352
Dominican Republic	8,861,412	48,730	4,618	59	1,205	21	2,370
Puerto Rico	3,928,740	8,950		18	2,056	7	1,782
Caribbean Latin America total	24,154,962	168,540		225	1,335	66	2,732
Argentina	38,226,050	2,780,400	7,666	1,642	591	814	21,294
Bolivia	8,986,396	1,098,580	1,758	1,259	1,146	623	69,271
Brazil	178,718,400	8,514,880	8,114	15,336	1,801	8,233	46,067
Chile	15,956,000	756,630	9,645	1,152	1,522	922	57,784
Colombia	45,300,000	1,138,910	5,056	2,975	2,612	2,132	47,064
Ecuador	13,213,080	283,560	4,202	592	2,087	432	32,695
Paraguay	5,781,569	406,750	2,365	460	1,130	336	58,116
Peru	27,546,700	1,285,220	4,345	2,234	1,738	1,913	69,446
Uruguay	3,399,400	176,220	10,790	223	1,265	139	40,89
Venezuela	26,127,000	912,050	11,503	1,710	1,875	1,233	47,200
Southern Latin America total	363,254,595	17,353,200	7,345	27,581	1,589	16,777	46,185
Latin America total	530,325,674	19,978,580	7,143	30,417	1,084	17,990	27,942
The world	6,345,127,000	133,941,500	8,594	107,924	806	43,764	6,897

* 2009 World Bank.
Source: [1].



Fig. 1. Latin America.



Fig. 2. River Caroní (average flow: 4,850 m³/sec) tributary of the Orinoco river (average flow: 33,000 m³/sec).

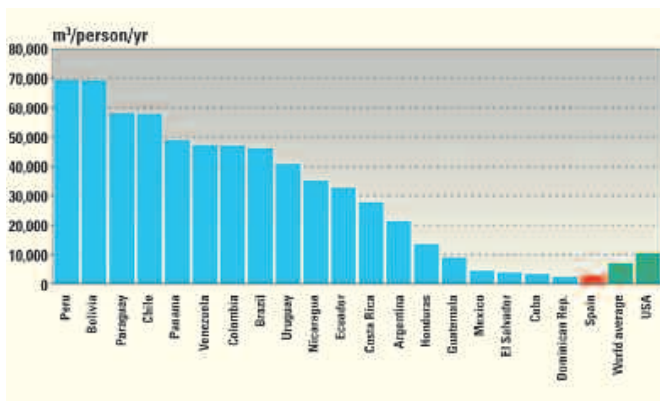


Fig. 3. Water availability in Latin America. Source: [1].

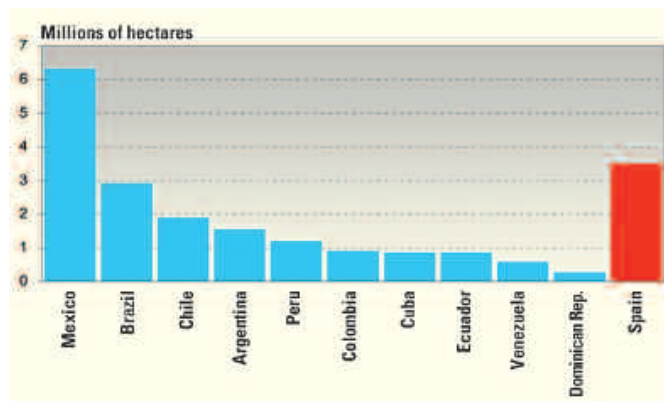


Fig. 4. Main irrigated areas in Latin America. Source: [1].



Table 2
Latin America: water use statistics

Country/subregion	Extractions		Extraction by sector (%)			Urban drinking water coverage 2002 (%)	Urban sanitation coverage 2002 (%)	Wastewater treated 2000 (%)	Permanent crops 2002 (thousands of ha)	Surface irrigation 2002 (thousands of ha)	% irrigation 2002
	hm ³	% renewable water res.	Agriculture	Industry	Domestic						
Mexico	78,219	17	77	5	17	97	90	15	27,300	6,320	23
Northern Latin America total	78,219	17	77	5	17	97	90	15	27,300	6,320	23
Costa Rica	2,677	2	53	53	29	100	89	4	525	108	21
El Salvador	1,273	5	59	16	25	91	78	2	910	45	5
Guatemala	2,005	2	80	13	6	99	72	1	1,905	130	7
Honduras	860	1	81	11	8	99	89	0	1,428	80	6
Nicaragua	1,300	1	83	3	14	93	78	34	2,161	94	4
Panama	824	1	28	5	66	99	89	18	695	35	5
Central Latin America total	8,939	1	65	12	22	96	80	10	7,624	492	6
Cuba	8,204	22	69	2	29	95	99	19	3,788	870	23
Dominican Republic	3,386	16	66	2	32	98	67	49	1,596	275	17
Puerto Rico	-	-	-	-	-	-	-	-	-	-	-
Caribbean Latin America total	11,590	20	68	2	30	96	85	32	5,384	1,145	21
Argentina	29,072	4	74	9	16	97	-	10	35,000	1,561	5
Bolivia	1,387	0	83	3	13	95	58	30	3,106	132	4
Brazil	59,298	1	62	18	20	96	83	15	66,580	2,920	4
Chile	12,539	1	64	25	11	100	96	17	2,307	1,900	82
Colombia	10,711	1	46	5	50	99	96	11	3,850	900	23
Ecuador	16,980	4	82	5	12	92	80	5	2,985	865	29
Paraguay	489	0	72	9	20	100	94	8	3,115	67	2
Peru	20,132	1	82	10	8	87	72	14	4,310	1,195	28
Uruguay	3,146	2	96	1	2	98	95	77	1,340	181	14
Venezuela	8,368	1	47	7	45	85	71	10	3,408	575	17
Southern Latin America total	162,122	1	68	13	19	95	73	13	126,001	10,296	8
Latin America total	260,870	3	71	10	19	97	86	63	166,309	18,253	11
The world	3,802,320	9	-	-	-	94	-	-	-	-	-

Source: [1].



Fig. 5. Monción Contraembalse dam (Dominican Republic).
Source: Ferrovial Agromán.



Fig. 6. Diagram of the San Francisco river diversion.
PISF Project. National Water Agency (Brazil).

These figures are still low compared with the basic needs of the Latin American population. The United States has an additional 150 million hectares of prairies for a population of 300 million inhabitants.

In Latin America there are magnificent feats of engineering for making good use of water in irrigation, especially the large dams and reservoirs built for water regula-

tion and storage. The Yacambú dam in Venezuela has enabled the creation of 21,000 hectares of irrigated land and supplies the city of Barquisimeto through a transfer of water from the Orinoco river basin to the Caribbean. The Santa Juana dam has allowed 12,000 hectares of land to be irrigated in Chile. Also noteworthy are the large dams in the Dominican Republic along with those of Monción,

Table 3
Construction of dams in Latin America by Spanish companies

Dam	Location	Year	Main characteristics				Spanish companies in construction	Owner
			Type (1)	Height (m)	Dam volume (thousands of m ³)	Purpose (2)		
Portezuelo branch	Neuquen (Argentina)	1973	G	20	30	- - H -	Dragados	Hidronor
Portezuelo	Neuquen (Argentina)	1973	G	34	160	- - H -	Dragados	Hidronor
Portezuelo Grande	Neuquen (Argentina)	1973	Earth	14	500	- - H -	Dragados	Hidronor
Las Barlas	Dominican Republic	1973	CFRD	15	370	I - H -	Ferrovial Agromán	INDRHI
Las Maderas	Jujuy (Argentina)	1975	Earth	98	4,500	I - H -	Dragados	Jujuy Province
Valdesia	Dominican Republic	1975	G	80	600	I - H -	Ferrovial Agromán	INDRHI
Futalefu	Chubut (Argentina)	1976	CFRD	130	6,000	- - H -	Dragados	Agua y Energía Eléctrica
Santa Rita	Medellín (Colombia)	1976	RFIC	50	5,500	- - H -	Acciona	Empresas Públicas de Medellín
Bahía Blanca dam	Bahía Blanca (Argentina)	1977	Earth	32	5,600	- S - -	Acciona	Department of Sanitation, Buenos Aires
Guri Final Stage	Bolívar (Venezuela)	1978	G	170	3,600	- - H -	Dragados	Edelca
Rincón	Dominican Republic	1978	G	54	170	I S H -	Ferrovial Agromán	INDRHI
Las Peñas Blancas Dam	Prov. Santa (Argentina)	1981	G	12	30	- - H -	Dragados	Agua y Energía Eléctrica
Hatillo	Dominican Republic	1983	RFIC	51	16,000	I - H -	Ferrovial Agromán	INDRHI
Yacambú	Lara (Venezuela)	1983	CFRD	160	6,956	I S - -	OHL	MARN
Salvajina	Cali (Colombia)	1985	CFRD	160	3,500	- - H -	Dragados	CVC Colombia
Condorama	Majes (Peru)	1987	RFIC	92	4,800	I - H -	Acciona	Autonomous Authority of Majes
Daule Peripa	Ecuador	1987	RFIC	90	8,000	I S H -	Ferrovial Agromán	CEDEGE
López Angostura	Dominican Republic	1987	RFIC	21	200	I S H -	Ferrovial Agromán	INDRHI
Agua del Toro	Mendoza (Argentina)	1988	Arch	116	320	- - - -	-	-
Gera	Tarapoto (Peru)	1988	G	18	6	- - H -	-	-
Iruro	Iruro (Peru)	1988	CFRD	49	253	- - - -	-	-
Paso de las Piedras	Buenos Aires (Argentina)	1988	RFIC	55	3,280	- - - -	-	-
Sabaneta	San Juan (Dominican R.)	1988	RFIC	70	6,300	I - H -	Dragados	-
Santo Domingo	Mérida (Venezuela)	1988	Arch	61	119	- - - -	Dragados	MARN
Sisa	San Martín (Peru)	1988	G	10	-	I - - -	-	-
Guavio	Boyacá (Colombia)	1989	RFIC	247	16,674	- - H -	Acciona	Empresa de Energía de Bogotá
Río Blanao	Dominican Republic	1990	-	-	-	- - - -	Acciona	Corporación Dominicana
Río Grande II	Medellín (Colombia)	1992	RFIC	-	2,524	- - H -	Acciona	Empresas Públicas de Medellín
San Rafael	Nayarit (Mexico)	1994	G(RCC)	45	97	- - H -	Acciona	Federal Electricity Commission
La Esperanza	Manabí (Ecuador)	1995	Earth	58	4,500	I S - -	Dragados	CRM (Ecuador)
Santa Juana	Chile	1995	CFRD	106	2,700	I - - -	Ferrovial Agromán	Irrigation Management, Ministry of Public Works
Pangue	Chile	1996	G(RCC)	115	790	- - H -	Dragados	Pangue, S.A.
Monción Contraembalse dam	Dominican Republic	2000	FSHD-RFIC	28	175-450	I S H -	Ferrovial Agromán	INDRHI
Porce II	Antioquia (Colombia)	2001	G(RCC)	123	1,450	- - H -	Dragados	Empresas Públicas de Medellín
Las Juntas	Los Ángeles (Chile)	2001	Earth	15	350	- - H -	Acciona	Sociedad Iberoam. de Energía, S.A.
Rucacura	Los Ángeles (Chile)	2001	Arch	15	35	- - H -	Acciona	Sociedad Iberoam. de Energía, S.A.
Monción	Dominican Republic	2002	RFIC	122	2,890	I S H -	Ferrovial Agromán	INDRHI
Dukeko	Chile	2003	Earth	15	60	- - H -	Acciona	Sociedad Iberoam. de Energía, S.A.
Maguaca	Dominican Republic	2003	RFIC	30	49	I - - -	Ferrovial Agromán	INDRHI
Villarpando	Dominican Republic	2003	G(CCR)	7	24	I - - -	Ferrovial Agromán	INDRHI
Caruachi	Bolívar (Venezuela)	2004	G	72	1,705	- - H -	Dragados	EDELCA
El Bato	Chile	Cons.	-	56	2,328	I - - C	Ferrovial Agromán	Ministry of Public Works
El Portugués	Puerto Rico	Cons.	Arch(RCC)	67	283	- - - C	Dragados	US Army Corps of Engineers

(1) BD: Buttress Dams; G: Gravity; Earth: Earth; Arch: Arch; RFIC: Rockfill Dam with Impervious Core; CFRD: Concrete Faced Rockfill Dam; AFRD: Asphalt Faced Rockfill Dam; G(RCC): Gravity (Roller-Compacted Concrete); G(FSDH): Gravity (Hardfill).

(2) I: Irrigation; S: Supply; IU: Industrial Uses; N: Flood Control; H: Hydropower.

Source: [4].

Valdesia, Sabaneta, Rincón and Hatillo among others and the dams in Daule-Peripa in Ecuador, Condorama in Peru and Las Maderas in Argentina. All are good examples of extractions for irrigation usage and other uses too, and all were built by Spanish companies.

There are currently plans in Latin America for more very important new irrigation projects. The Brazilian Na-

tional Water Agency's implementation of the San Francisco River Integration Project with the hydrographic basins of the northeast (PISF) stands out; it plans a diversion from the San Francisco river to the states of Ceará, Rio Grande del Norte, Paraíba and Pernambuco, where there are 12.5 million people with no guaranteed water supply in a zone with a great shortage of resources. Water will flow



at 26.4 m³/sec, with a maximum capacity of 127 m³/sec, through two canalizations, the North Axis and the East Axis, with a total length of 2,200 km.

Modernisation of irrigation

Generally, in Latin America, the most commonly-used irrigation technique is surface flooding (87%); sprinkler irrigation is less widely-used (10%), and localized irrigation has very low use (2%) and is the most technologically sophisticated method. Brazil and the Antilles are exceptions, with 35% sprinkler use.

The amount of water used for irrigation is determined by the type of crop, the local climate, and, to a large degree, the irrigation technology used. Resources allocated for irrigation in South America range between 9,000 and 12,000 m³/ha/yr. Mexico's average is 13,500 m³/ha/yr, but these figures are higher still in Central America, where intensive crops like rice, banana and sugar are grown. These irrigation allocations contrast with the usual levels of more modern irrigation systems in the southeast of Spain (Tagus-Segura transfer), whose fundamental technology is localized drip irrigation which enables allocations of 4,000 m³/ha/yr for fruit trees under extreme drought conditions, which can achieve water savings of 50% (and even higher) compared to other systems.

The huge advantages of localized irrigation as an efficient technique have not gone unnoticed in Latin America, and not just for their efficiency in terms of saving water, but also for the opportunities for automation, fertigation and improvements in the quality of life for farmers that it entails. And so an unstoppable trend can be observed in Latin America of shifting from surface irrigation to localized irrigation. This will bring about a significant breakthrough in water resources management because of

the enormous volume of water used by irrigation and the predicted savings. It is a new challenge.

The situation in Mexico is especially significant since it is experiencing spectacular growth in the use of sophisticated irrigation techniques, mainly because of its advantageous geostrategic position for exporting vegetable products to the United States (a neighbour with a large population and a large purchasing power). An effect similar to the one experienced by Spain when it joined the European Union (in 1986) with its market of 500 million consumers.

Supply and sanitation

The urban nature of Latin America's population and the existence of large metropolitan areas with wide demographic extension generally lead to significant gaps in infrastructure and corresponding urban water services.

The large size of cities requires the movement of massive volumes of water to guarantee its supply and purification. The high cost of installation, renovation and maintenance of extensive water supply and sanitation networks, along with difficulties in financing and charging users, are problems that need to be solved in order to attain efficient usage and guaranteed healthy drinking water (without service restrictions, water losses and pollution).

The coverage of service for drinking water in Latin America's urban areas is relatively high; almost all its countries have more than 90% coverage, the ideal goal of 100% enjoyed by the world's other developed countries (United States, European Union) remains far off.

One example is the supply in Mexico City and its surrounding metropolitan area, with 20 million inhabitants (the second most populous metropolitan area in the world after Tokyo). It draws its supply from groundwater (aquifers in the Valley of Mexico) and from water transferred from the Lerma and Cutzamala basins. The Cutzamala transfer system, 150 km long and 24 m³/sec, is a global standard. The supply of the city currently mobilizes more than 1,000 hm³/year and still requires new resources in spite of water-saving measures. The availability of water of sufficient quality and quantity in Mexico City is a national priority. Furthermore, it has a secondary distribution network of 10,000 km of pipelines, which gives some idea of its size. Added to these general problems, there is a bigger problem still: land subsidence of the city (10-40 cm/yr) due to the overexploitation of the underlying aquifer. Mexico City's sanitation is a deep drainage system which transports wastewater and rain runoff to the river Tula, Pánuco and the Gulf of Mexico.

Latin America's urban drainage and sanitation infrastructure situation varies greatly from country to country, with coverage ranging from 58% to 99%, whereas the ideal figure would be 100%. One of the Millennium De-



Fig. 7. Modernised irrigation infrastructure. Sinaloa (Mexico).
Source: Novedades Agrícolas.

velopment Goals (MDGs) is precisely to reduce these gaps in access to safe drinking water and sanitation.

Desalination of seawater as a source of drinking water has not been implemented on a wide scale in Latin America. It is an expensive process, and costly in energy terms as well, compared with traditional processes. However, there are projects being carried out in arid areas where there are no other options. The desalination plant in Los Cabos (Baja California Sur), Mexico, is an example of one carried out by Spanish companies.

Wastewater treatment

In all Latin American countries there is a widespread lack of wastewater treatment. Urban wastewater is discharged into rivers, lakes and seas with no, or very little, treatment. The problem is greater due to the size of its urban centres. Sometimes the great capacity for dilution of these receptors masks the problem.

The effects of pollution from large cities are well-known in the Reconquista river (Argentina), Tieté and Paraíba rivers (Brazil), Bogotá river (Colombia), the Rio Grande De Tárcoles (Costa Rica), the Sucio river (El Salvador) and the Tula river (Mexico).

In South America 13% of wastewater is treated, in Central America, 10% and in Mexico, 15%. All the figures are generally very low, with the exception of Uruguay (77%) which was exactly the first country in Latin America to enshrine the right to drinking water and sewerage in its Constitution.

All wastewater treatment levels in Latin America are far from the United States' and most European Union countries' 100%. A good model for the region could be the European Union's Directive on wastewater treatment (1991), which established in law the obligation to provide treatment systems and has prioritised budgeting for structural funds.

In Latin America this gap must be closed in order to protect and renew its bodies of water. Initiatives are already under way. An important step has been the start of construction of the world's largest wastewater treatment facility, the EDAR in Atotonilco, which will annually treat some 1,000 hm³ of waste water in the Valley of Mexico and will also enable its reuse in the irrigation of 80,000 hectares of land. The Taboada wastewater treatment project is also a first step, where 700 hm³ of, wastewater from Lima, Peru will be treated. Both projects are being carried out by Spanish companies.

Hydroelectric energy

The abundance of water in Latin America provides enormous opportunities for hydroelectric energy generation. It has 22% of the world's global hydroelectric potential, estimated at 3,887 GW.

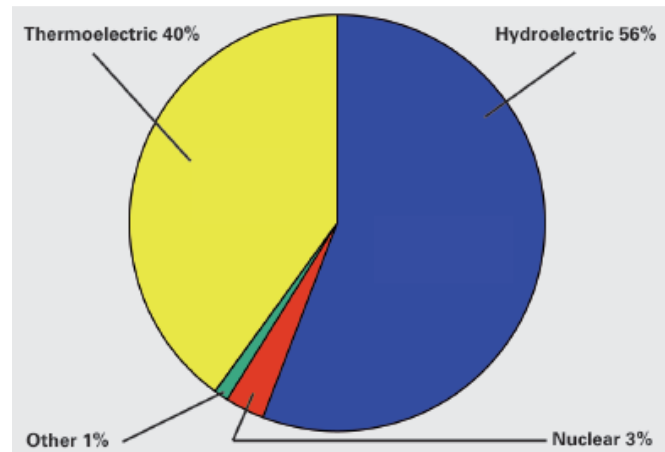


Fig. 8. Distribution of hydroelectric production in Latin America. Source: Latin American Energy Organization – OLADE – (2003), [1].

Country	Installed hydroelectric capacity (MW)	Hydroelectric energy generated (GWh)
Brazil	67,791	290,006
Venezuela	12,491	60,177
Paraguay	7,410	51,762
Colombia	8,893	35,952
Argentina	9,782	33,777
Chile	4,279	24,177
Mexico	9,849	19,753
Peru	3,032	18,538
Uruguay	1,538	8,578
Ecuador	1,733	7,180
Costa Rica	1,295	6,022
Panama	833	2,871
Bolivia	479	2,307
Guatemala	627	2,177
Honduras	466	1,745
El Salvador	442	1,705
Dominican Rep.	542	1,562
Nicaragua	104	297
Cuba	57	78
Total	131,643	568,663

Source: OLADE (2003), [1].

Hydroelectric energy generation is one of the most important sectors and has achieved the highest level of technological sophistication in Latin America. 56% of the region's electricity comes from hydroelectric power sources. In Spain, a country with a long tradition and considerable technology, coverage is 9%.

Civil engineering has decisively contributed to hydroelectric development through the implementation of very prominent projects at an international level. The Itaipu hydroelectric station (Brazil-Paraguay) is the second largest in the world, with a capacity of 14,000 MW and a 29,000 hm³ dam.

For countries, Brazil stands out, generating half of all the hydroelectric energy produced in Latin America. Venezuela, Paraguay, Colombia, Argentina, Chile, Mexico and Peru follow in descending order of hydroelectric power generation.



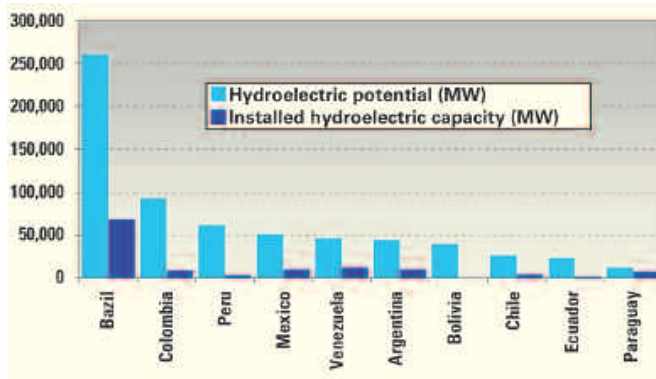


Fig. 9. Development of hydroelectric energy in Latin America. Source: OLADE (2003), [1].



Fig. 11. View of the Caruachi dam and hydroelectric power facility (Venezuela). Energy production. 2,160 MW. Source: Dragados.



Fig. 10. Guavio dam (Colombia). Energy production. Rockfill dam with impervious core; height, 247 m, reservoir 1,140 hm³. Plant, 1,600 MW. Source: Acciona and Endesa.

The capacity actually installed in Latin American countries compared with their potential for hydroelectric generation shows there are still many opportunities for development, because barely 20% of economically-viable hydroelectric potential has been used, whereas in the United States and Europe, the figure is over 60%. Presently important projects are being considered, amongst them, Brazil's Belo Monte Hydroelectric dam complex (11,233 MW) stands out.

Spanish engineering, construction and hydroelectric companies have all contributed to the development of hydroelectric energy in Latin America. Outstanding achievements, such as the Guavio dam in Colombia, which, with its 247 metres in height, and 1,600 MW plant, is one of the largest rockfill dams in the world. The Caruachi dam in Venezuela, with 2,160 MW of power installed, also stands out in a list of more than thirty large hydroelectric projects carried out across the continent.

Future perspectives on infrastructure

In Latin America there is a shortage of hydraulic infrastructure which slows the region's economic, social and environmental progress.

Latin America has an average GDP per capita of about 7,000 dollars, with the highest being in Venezuela, Uruguay and Chile (around 10,000 dollars). The global average of GDP worldwide; is about 8,600 dollars; in Latin America's neighbour to the north, the United States, it is 46,000 dollars. These values of GDP in Latin America are in no way proportional to their richness in natural resources.

However, one can see the region has the conditions and potential needed to reduce the enormous gaps and to make rapid progress in socioeconomic terms. Another factor that can decisively contribute to this is the implementation of hydraulic infrastructure than can supply water (needed for urban, industrial and irrigation use) and hydroelectric energy (the cheapest, cleanest and highest quality energy). Water and energy are vital elements in a country's production system and for its citizens' quality of life. They are renewable resources (because they flow) and not to take advantage of them would be a missed opportunity.

There is still a long list of traditional hydraulic works needed in Latin America: flood retention and abatement dams, pipelines, hydroelectric power plants, irrigation and drainage networks, embankments and road flooding protection, urban water supply networks and sewage systems, water treatment plants, among others, not to mention renovation and improvements to existing infrastructure and exploitation and conservation works. In many cases, it will be possible to complete these works while respecting the environment and minimising their environmental impact.

There are also other types of unconventional infrastructure whose scarcity in Latin America is highly significant: modernisation of irrigation systems and treatment and reuse of wastewater. They are actions which are welcomed by society because, as well as their socioeconomic benefits, they produce great benefits for the environment: large water savings and cleaner rivers.

Water governance in Latin America [2] The predominance of one sectoral focus

In the majority of Latin American countries, water management has had an essentially sectoral focus. Historically, administration has been entrusted to the managers of specific water use areas: irrigation, hydroelectric power generation and sanitation and drinking water services.

This sectoral focus has normally been accompanied by other approaches, such as the separation of surface water and groundwater, the segregation of concession management from water pollution control, administration by river courses or by political regions; basically, the breaking up of the water cycle.

These focuses, generally, lead to gaps, duplicity and complexity in management, something that, in turn, often leads to less efficient water use and deterioration of the resources. However, perhaps the most significant consequence is that the desirable goal of public interest in decision making can be obscured. Although, undoubtedly huge successes and progress have been achieved, these have been, largely, thanks to hydraulic engineering.

The implementation of integrated water resources management in Latin America is still not a priority for many countries. More pressing water management goals are very apparent, such as tackling the lack of basic infrastructure, improving the economic efficiency of water use, the provision of public services related to water, reducing pressure on state budgets, promoting participation and investment from private sources and growing interest in using economic instruments, such as tariffs, to improve the use and allocation of water.

In Latin America there are very few examples of administrative structures that address water planning and management in an integrated way. Today, only two countries, Brazil and Mexico, include management by hydrographic basins in their legislation. The following section details the national models of these two countries and table 5 (see next page) describes the national models of other Latin American countries, which are still struggling to achieve integrated water management, such as Argentina, Chile, Bolivia, Ecuador, Peru, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and the Dominican Republic.

Management by hydrographic basins in Latin America. Brazil and Mexico

Brazil has one of the most modern water management systems in Latin America. In 1997 the federal government established the National System for the Management of Water Resources, which implements, with an integrated vision, national water policy and environmental water protection.



Fig. 12. Panguel dam (Chile). Source: Endesa.



Fig. 13. Hatillo reservoir (Dominican Republic). Irrigation and energy production. Source: Ferrovial Agromán.



Table 5	
National water administration models in Latin America	
<p>In Argentina, a country with a federal structure, water resources management has a sectoral approach, broken up by institution. Each province controls the natural resources found within its territory. There is no national water law which covers the whole national area.</p> <p>Argentina's Constitution (reformed in 1994) establishes the Nation as responsible for legislation on environmental matters. The Ministry of Health is responsible for environmental protection and its Secretary of Environment and Sustainable Development is responsible for environmental water management. This is coordinated with the Ministry of Federal Planning, Public Investment and Services, whose Public Works Department has primary jurisdiction in national water policy.</p>	<p>In Costa Rica, the 1942 Water Law is in effect. As well as abundant sectoral legislation and regulation, it regulates issues such as drinking water, hydroelectric power generation and irrigation services.</p> <p>The 2002-2006 National Development Plan highlights the need for interagency coordination and the definition of a policy and national plan for the integrated management of water resources.</p> <p>The Ministry of Environment and Energy (MINAE) is the lead agency for water management. However, this ministry has still not fully taken over this function and many other organisations also bear responsibilities in this area.</p>
<p>In Chile there are two organisations relating to water as a resource: The General Water Directorate (DGA), Ministry of Public Works (MOP) and the National Environmental Commission (CONAMA).</p> <p>The 1981 Water Code mandates the DGA as responsible for water resource policies, planning, extractions and control and usage of bodies of water. The DGA is a non-sectoral entity and independent from users, it does not carry out infrastructure work, which allows it to play its regulatory role with great impartiality. CONAMA, in turn, must coordinate government action on environmental issues.</p> <p>Other organisations are: The Hydraulic Works Directorate of the MOP, the National Irrigation Commission, the Superintendency of Sanitation Services (regulating drinking water and sanitation services), the Institute of Agriculture and Farming among others.</p>	<p>In El Salvador, sectoral laws created autonomous agencies responsible for drinking water and energy. The law on irrigation and drainage establishes usage rights. The institutional structure for water resources is centralised in the Ministry of Environment and the Ministry of Agriculture, and more specialised functions are assigned to other government agencies. Recently the National Water Agency was created, with a more integrated approach to water resources.</p> <p>In Guatemala there is no general water law, instead there are several sectoral laws. The Ministry for Agriculture, Livestock and Food has been the lead agency for water management. The Intergovernmental Commission of Water Resources is responsible for coordination between the different public water agencies.</p>
<p>In Bolivia, a move towards integrated water resources management was the Protection and Conservation of the Environment and Natural Resources Act of 1992, which established that planning, protection and conservation of water resources and integrated management and control of the basins were a national priority and the State was responsible for its promotion. According to this law, integrated management of resources at a basin level is one of the fundamental tools for environmental planning.</p>	<p>In Honduras, the General Water Act of 1927 is in effect. In 2003, the Drinking Water and Sanitation Act was passed. The Secretariat of Natural Resources and Environment is the government body responsible for water matters. Other agencies involved in water are the Secretary of Agriculture and Livestock, the National Electric Energy Company and the National Autonomous Service of Aqueducts and Sewers.</p>
<p>In Ecuador, the Water Act of 1960 recognised water as a national resource whereas previously it was private property. Since 1994 significant changes have occurred with the creation of the National Council for Water Resources. The Ministry of Housing is responsible for drinking water and sanitation services and the National Electrification Council for hydroelectric power generation.</p> <p>The Decentralised Environmental Management System (1999) is a cross-agency coordinating body over several areas of environmental management. It is subject to guidelines from the National Council for Sustainable Development.</p>	<p>In Nicaragua, the vast legislation is sectoral in nature. Representatives from sectoral agencies make up the National Commission of Water Resources for its interagency coordination. There is no general water law, nor are they orientated towards integrated water management. The National Action Plan for Water Resources' main objective is integrated management.</p>
<p>In Peru, the current water legislation is the General Water Law (1969) which has a clear agricultural bias. A proliferation of regulatory rulings has changed substantive aspects of the original legislation. One significant attempt was the creation of the Autonomous Hydrographic Basin Authorities in 1991. Only five were created, but they have not worked.</p> <p>The Administrative Division for Water Resources in the Ministry of Agriculture is the national water authority, responsible for ensuring water quality and has functional jurisdiction over the Irrigation District Technical Authorities. The Ministry of Health is the authority for matters concerning water quality and spillages. There is also the National Institute of Natural Resources.</p> <p>The Ministry for Housing and Construction's National Institute of Development has been responsible for major irrigation projects. Recently transferred to regional government (2002).</p>	<p>In Panama, the 1966 General Water Law is in effect. The Law on hydrographic basins (2002) has not yet been developed. Other sectoral laws referring to drinking water, irrigation, public health and hydroelectric power generation do exist.</p> <p>The basin of the Panama Canal has specific legislation from the Canal Authority.</p> <p>The National Environment Authority (1998) directs water management but is restricted to environmental issues. UNESCO sponsored the National Water Program.</p> <p>In the Dominican Republic, the supreme authority over surface and groundwater is the National Institute of Water Resources (Law 1965) which performs water management and extraction functions.</p>
Source: [2].	

The National System for the Management of Water Resources mainly comprises: The National Water Resources Council (abbreviated to *CNRH* in Spanish), the National Water Agency, Basin Committees and Water Agencies.

The CNRH is made up of representatives from the ministries related to water management, State Water Resources Councils, users and civil organisations; the president is the head of the Ministry of Environment (MoE) and its Secretary of Water Resources is responsible for creating the National Water Resources Plan and monitoring the operation of the National Management System.

The National Water Agency, a linked entity of the MoE, concentrates its water resource management roles on federally-owned bodies of water and is supported by the Basin Committees and Water Agencies.

The Basin Committees act as water parliaments in each of their respective basins and are made up of representatives from the federal government, states, municipalities, water users and civil organizations. Water Agencies are the Executive Secretariat of the Basin Committees.

Mexico is a federally-structured country. According to its Constitution (1917), water is the heritage of the nation and subject to the exclusive jurisdiction of the federal gov-

ernment. According to the Federal Water Act (1992, 2004), the federal executive branch is responsible for water matters, be it directly or through the National Water Commission (CONAGUA), an agency belonging to the Ministry of Environment.

The Commission, together with central and national agencies, is organised into thirteen hydrological regions, named Basin Organisations (since 2006), decentralised agencies of CONAGUA and fully subordinate to the central hierarchy.

The duties that correspond to the 32 federal states are almost entirely limited to water supply and sanitation services. These tasks are shared with 2,200 municipalities.

In Mexico, the organisation and participation of the users, especially agricultural users, is managed primarily through irrigation units, agricultural drainage, irrigation districts and technified rainfed districts.

Trends

In matters of water governance in Latin America, progress can be made with an integrated and participatory approach; by introducing water planning techniques as a rational method for seeking the public interest and greater



Fig. 14. Modernised irrigation systems. Culiacan (Mexico).
Source: Estructuras Solares del Mediterráneo S.A.



Fig. 15. Porce II dam (Colombia). Energy production.
Source: Dragados.

social and economic benefits; and by including environmental policies and principles of water cycle unity and of hydrographic basin management units.

Some Latin American countries are already in the process of changing or planning new water laws and there is interest in advancing in this direction. One cannot ignore the influence of the effects of a series of international events and treaties signed by countries from the region, such as the UN Conference on Environment and Development (Rio de Janeiro, Brazil, 1992), and the World Water Forums (The Hague, Netherlands, 2000; Kyoto, Japan, 2003; Mexico City, Mexico, 2006; Istanbul, Turkey, 2009). In particular the World Summit on Sustainable Development (Johannesburg, 2002) which endorsed the IWRM concept (Integrated Water Resources Management) that had a very important role to play at the 4th World Water Forum, held in Mexico (2006).

Concluding remarks

As has been shown, in Latin American countries, one cannot speak of a water resource crisis caused by physical scarcity, since it is the most water-rich region in the world, this serious crisis, when it occurs, is due to shortcomings in management or infrastructure.

Spain can serve as a good reference point for Latin America, given its water culture that spans millennia due to its climate and the irregularity of its rivers, along with its historical trajectory in the western world and its membership of the European Union.

In integrated management and management by hydrographic basin, Spain has been a pioneer in the world with the creation of its Basin Agencies in 1926, a model that has been implemented throughout the European Union with its Water Framework Directive in 2000.

For hydraulic works, Spain has an ancient tradition and knowledge both in the construction of dams and aqueducts (Roman heritage) and in the implementation of irrigation

systems (mainly Arab heritage). Works like the Imperial Canal of Aragon (18th Century) or the Tagus-Segura transfer (1979) are examples from a very long list of achievements. With more than 1,300 large dams in operation, Spain is in fourth place in the world and first in Europe for large dams.

Historically, the contribution of Spanish companies has been very important for water use in Latin America. They have been building dams since the sixteenth century, and in just the last thirty years they have built more than forty large dams in the region. This has been possible thanks to Spanish businesses' expertise as well as for historical and language reasons.

Over the last decade, Spain has also garnered prestigious international recognition for its implementation of unconventional water infrastructure, such as wastewater treatment and recycling, seawater desalination and modernisation of irrigation, fields in which national and international actions are of global importance right now. This emerging field is a crucial area, because Latin America's gaps in coverage are vast and there is growing social pressure for this work to be carried out.

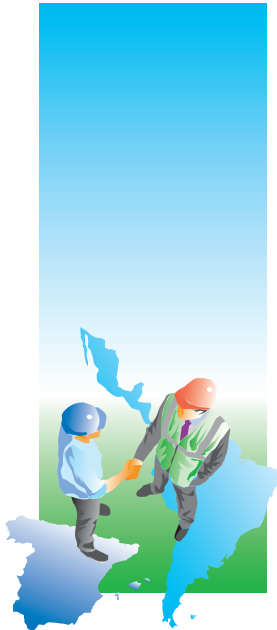
For water and energy, the relationship between Latin America and Spain must be for mutual benefit. It is a great opportunity for growth in Latin America and it is a great opportunity for Spanish business groups who have the knowledge and ability to contribute to encouraging this growth. Water and energy are the twin pillars of prosperity for the people. □

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The Cooperation Fund for Water and Sanitation and its contribution to achieving the MDG

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KEYWORDS

SPANISH COOPERATION FUND FOR WATER AND SANITATION
MILLENNIUM DEVELOPMENT GOALS
LATIN AMERICA
WATER RESOURCE MANAGEMENT IN SPAIN

The Cooperation Fund for Water and Sanitation (Fondo de Cooperación para Agua y Saneamiento): Goals

In November of 2007, at the Ibero-American Summit in Santiago, Chile, the creation of the Spanish Cooperation Fund for Water and Sanitation (FCAS) was announced with a budget of 1.5 billion Euros and directed at Latin American countries. 2008's Spanish Government Budget officially created¹ and institutionalised it, with two objectives:

- Firstly: implement the human right to water; no small matter, since it is not just a simple moral goal or a mere political aspiration, but rather involves providing support for large national schemes which, in many cases, assume express or implicit acknowledgement of this right by governments, which are subsequently obliged to respect, protect and implement it. It also involves a series of technical criteria, in accordance with General Comment No. 15 (2002) made by the International Covenant on Social, Economic and Cultural Rights.² So, to successfully implement the human right to water, it must be available, healthy, accessible, affordable and universal and there should be facilities for accessing information about it.
- Secondly: contribute to achieving the Millennium Development Goals (MDGs), specifically Target C of Goal 7: "By 2015, halve the proportion of people without sustainable access to safe drinking water and basic sanitation"³ For the purpose of measuring progress, access to drinking water is defined as sources of *improved water* (according to the Joint Monitoring Programme for Water Supply and Sanitation⁴). Improved water sources are: Piped household connections, public standpipes, tubewells or boreholes, covered wells, protected

springs and rainwater collection systems. The following are considered *unimproved water sources*: uncovered wells and springs, rivers or surface water, water supplied by vendors, bottled water, water from tankers/trucks, or any installation which cannot be reached without enduring physical risks). Regarding sanitation, only *improved* sanitation installations are considered, i.e. piped sewer systems, septic systems, ventilated improved pit latrines, pit latrines with slab, and composting toilets (the following are not considered for access to sanitation: any kind of public or shared latrine, latrines which are not connected to the sewer or septic system, pit latrines without slabs, latrines without buckets or roof, or any installation which is physically unsafe to access).

FCAS, run by the Spanish Agency for International Development Cooperation (AECID), not only finances water and sanitation work, but also institutional strengthening for recipients, from the ministers charged with water management to the operators working on the land. This emphasis is to ensure the long-term sustainability of projects and avoid previous experiences where once works had been completed, they quickly became obsolete due to lack of maintenance or users' inability to pay for it.

Today FCAS supervises important national programs, some which have a total cost of more than 100 million dollars. With the present list of approved projects it is hoped more than ten million people will benefit from FCAS-financed initiatives. As for the MDGs, it is estimated that these projects will contribute 29% to the water supply target and 12% to the sanitation target of Millennium Goal 7, Target C. As we will see later, the concentration of this ambitious project of Spanish cooperation on the water sector is no accident.



Fig. 1. Well built in a rural area of Costa Rica. Source: DFCAS⁵



Photo: David Ruyman de Ceto

Fig. 2. Rivers are the only source of water in many areas of Guatemala.



Why a water and sanitation fund?

“Quod iudicium nostrum est qua de re agitur secundum Salluienses iudicamus”. The above sentence from the *Tabula Contrebiensis*⁶ of 87 BC rules in favour of the inhabitants of Salduie against those of the town of Alaun who were unhappy with the former’s purchase of land to build a water channel. Thus begins the history of water management in Spain. It is a history replete with landmark events which, without wanting to be chauvinistic about it, puts Spain at the head of water management and water technology. Necessity is indeed the mother of invention; the inhabitants of the Iberian peninsula have had to create systems to solve their climatic and territorial imbalances to such an extent that today, 92% of water consumption comes from artificially-altered sources, or, put another way, only 8% is obtained from natural sources (compared with the European average of 40%)⁷.

“Through rules, now written and codified, no irrigator will be harmed nor damaged in their enjoyment of water and its usage and use”, reads article 33 of the original Water Law of 1866, which, although it did not enter into law, was the starting point for the nationalisation of water in our country, which led to the present 1985 Water Law, where the process is completed by including underground water.

Another landmark in our water management history takes place in 1926 when Spain creates the first river basin management organisation in the world, the Ebro River Hydrographic Confederation Union (*Confederación Sindical Hidrográfica del Ebro*)⁸, the product of a Royal Decree on 5th March of the same year, which states that in “all water basins where the Government sees fit or where 70% or more of its agricultural and industrial riches is affected by the use of its running waters, will form part of the Hydrographic Confederation Union”. This system of river basin organisations, now fully developed, has been the model and inspiration for basin management plans in many countries, and was established in the EU Water Framework Directive of 2000,⁹ as the basis of the present Hydrographic Demarcations.

Spanish experience in this sector and its well-developed operators and technology are what justifies concentrating resources on this particular area. A fund with the above characteristics has greater impact since it has human and technological resources which can be exported and put at the disposition of the Spanish cooperative organisation.

In order to use all this knowledge and ensure the participation of all the stakeholders in Spanish sector, FCAS has a *sui generis* body in the AECID, the Advisory Council, made up of representatives from the water and sanitation sector from foundations, non-governmental development organisations, water and sanitation operators and



Fig. 3. Example of a cooperative intervention on water and sanitation: water tank in the suburbs of Lima. Source: DFCAS.

managers, business organisations, specialist private companies, universities, and experts on the subject, a total of forty members. Its job is to analyse and deliver reports on operations being carried out, propose action plans to the Office which administrates FCAS, so they are actively involved in its management, taking majority-vote decisions.

Latin America and project sustainability

FCAS’ activities are centred on Latin America. At a moment when Ibero-American relations are being redefined, when the region has undergone a decade of economic growth and is now starting to look towards Asia, the maintenance and deepening of cooperative links between Europe and Latin American countries is vital.

Latin America is a region where paradoxes abound. Here is one more to add: there is an enormous quantity of water sources but a huge deficiency in the population’s actual access to drinking water and sanitation services, as shown in the graph in figure 5.

These low figures alone would not justify FCAS’ geographical concentration on Latin America, since there are other areas of the world which also have enormous shortfalls. FCAS has decided to concentrate on Latin America for several reasons. Firstly, for being our nearest neighbour; not geographically, but in cultural, historical and human terms. Secondly, because concentrating on those sectors and regions fits well with our cooperation strategy. Thirdly, because this ambitious project’s success and sustainability depends on the ability of the Spanish cooperation and our partners to properly develop the programmes together. This is a region where our cooperation has most human resources and infrastructure (existing cooperative technical departments). Lastly, thanks to the present state of socioeconomic and, above all, institutional development, in most Latin American countries, funding can be sent, safe in the knowledge it will be received and administered correctly.



Fig. 4. The Advisory Board brings together the main stakeholders in the water and sanitation sector and its purpose is to assist and propose courses of action for the Department of the Fund. Source: DFCAS.



MINISTERIO DE ASUNTOS EXTERIORES Y DE COOPERACIÓN



aecid

THE SPANISH COOPERATION FUND FOR WATER AND SANITATION

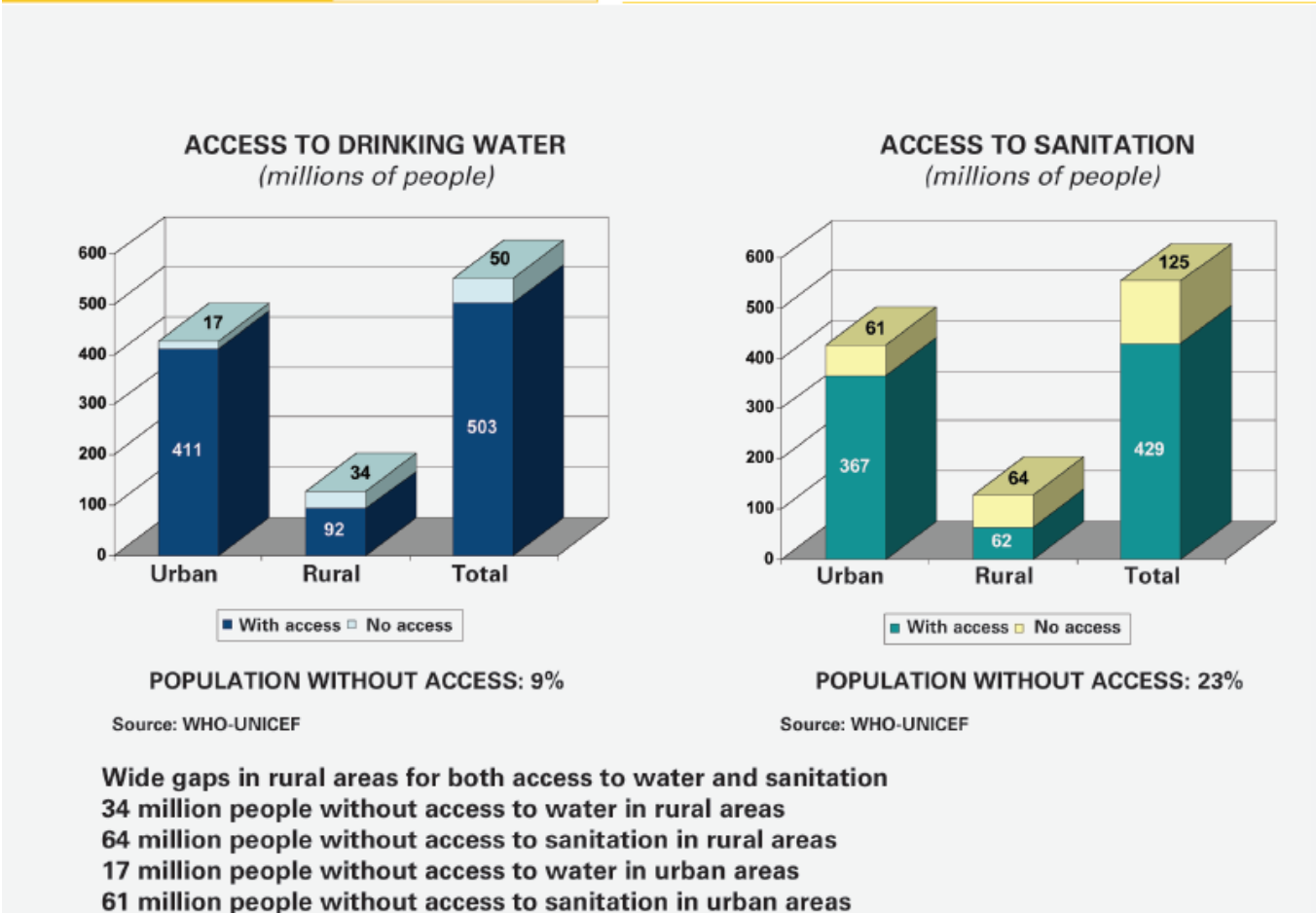


Fig. 5. Figures on access to water and sanitation in Latin America in urban and rural areas. Source: WHO-UNICEF (2006)¹⁰





Fig. 6. Improved access to water leads to adequate levels of hygiene, which prevents many diseases.

GROUP 1 Wide-ranging partnership countries Initiative for countries with high national debt 100% financing	GROUP 2 Wide-ranging and focussed- partnership countries 80% financing	GROUP 3 Countries with partnerships for consolidating development achievements 50% financing
Bolivia	Colombia	Argentina
Honduras	Ecuador	Brazil
Nicaragua	El Salvador	Costa Rica
Haiti	Guatemala	Chile
	Peru	Cuba
	Dominican Republic	Mexico
	Paraguay	Panama
		Uruguay
		Venezuela

Created by the Spanish Office for Water and Sanitation Cooperation.

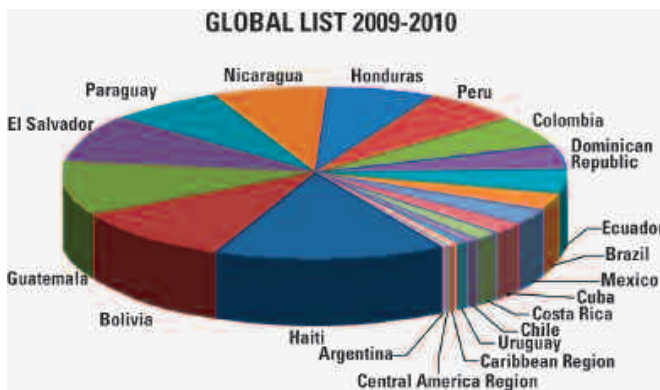


Fig. 7. Distribution of the FCAS budget by country according to the 2009-2010 project list.
Created by the Spanish Office for Water and Sanitation Cooperation.

If FCAS can be successfully implemented in Latin America, then it, and all the lessons learnt from it, will surely serve as a model for other regions.

How FCAS works

Following recent amendments to the Statute of the AECID by Royal Decree 941/2010, FCAS is naturally placed under the Sectorial and Multilateral Cooperation Authority (Dirección de Cooperación Sectorial y Multilateral), a dependant body of the Secretary of State for International Cooperation (Secretaría de Estado de Cooperación Internacional).¹¹

FCAS operates by providing grants¹² to programmes or projects. There is a permanent call for grant proposals¹³ from Latin American countries. Applications undergo a selection process. Beneficiaries are limited to public government (national, regional and local) and to non-profit civil society organisations.

Project funding, for which there is no predetermined maximum or minimum amount, takes place within a co-financing system, allowing even more resources to be leveraged. Levels of funding differ according to Latin American geographical priorities laid out in the Master Plan for Spanish Cooperation, 2009-2012;¹⁴ which fixes levels according to each country's debt and amount of water and sanitation shortage. The co-financing system established by FCAS for each member country is summarised in table 1.

In order to ensure funds reach the most disadvantaged areas with the greatest need, 85% of resources must be distributed between group 1 and group 2.¹⁵ To the same end, the selection of applicants from rural and peri-urban zones with less water and sanitation coverage are prioritised.

To be eligible, applications must contain at least one of the following action items:

- Sustainable access to drinking water.
- Sustainable access to basic sanitation services, including solid waste management.
- Strengthening of policies and institutional management frameworks for water, for better coordination and participation of said management.
- Strengthening integrated management of water resources.
- Establishment of sustainable supply systems of public water and sanitation services.¹⁶

FCAS' experience up until now

Up until now, FCAS has provided 900 million dollars to a total of 46 projects in Latin American countries between 2008 and 2009. Most of them are being started now, which involves defining the rules of operation for each project, i.e. an annual strategic plan for each project.



Fig. 8. Reviewing emergency supplies for Haiti in AECID's warehouse in the Torrejón de Ardoz airbase. Source: DFCAS.



Fig. 9. FCAS contributed to emergency aid efforts following the earthquake in Haiti by sending supplies for the distribution and sterilisation of water. Source: DFCAS.

The list of projects for 2010 will be finalised in the coming months. Taking into account the new, still undefined, proposals, FCAS' work by country is distributed as shown in figure 7.

Of all the projects carried out by FCAS, the work undertaken in Haiti after the tragic earthquake of 12 January, 2010 stands out. Thanks to having developed close working relations with the Haitian authorities before the earthquake, FCAS was able to decisively contribute in providing drinking water and basic sanitation services to those affected by the quake moments after the emergency occurred. FCAS gave DINEPA, the Haitian government's water and sanitation authority, 5 million dollars, 15 tonnes of supplies, and management and technical support, which allowed the Haitian authorities to ensure distribution and sterilisation of drinking water for those affected, and install sanitation for the crowds of newly-homeless people. This new construction project in Haiti took FCAS' commitment to 115 million dollars and with it leveraged an additional 25 million dollars from the Inter-American Development Bank, an essential FCAS partner for its multilateral profile.

Conclusions

The fruits of FCAS will not be seen for several years yet, when programmes and approved projects that are only just beginning to be implemented in almost all Latin American countries are completed.

These projects have ambitious aspirations, but they have been allocated the budget and technical means necessary to make them a reality. Their success will also be the success of our country's water and sanitation sector, whose management model has been exported to many administrations worldwide and which is now being used by the Spanish cooperation in helping achieve the Millennium Development Goals.

This experience should serve as a reference for other funds of the same, or other, nature. If proven effective, this model could be applied in the future in regions that need it just as much. □

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Notes

1. Additional provision to the 61st, Law 51/2007, 26 December, 2008 Spanish State General Budget, published December 2007 in the Spanish Official Bulletin of the State.
2. Committee on Economic, Social and Cultural Rights (2002). General Observation No. 15 "The Right to Water" (E/C. 12/2002/11).
3. General Assembly (6 September 2001). Secretary-General's Report, *A Road Map Towards the Implementation of the Millennium Declaration* (A/56/326).
4. World Health Organisation and UNICEF, *Joint Monitoring Programme for Water Supply and Sanitation*, WHO Press, Geneva, 2010.
5. DFCAS: Departamento del Fondo de Cooperación para Agua y Saneamiento (*Department of the Cooperation Fund for Water and Sanitation*).
6. The Tabula Contrebiensis, a bronze engraving found in Botorrita (Zaragoza, Spain) dating from 87 BC presently exhibited in the Zaragoza Provincial Museum. It provides an account of a dispute between the inhabitants of Salduie (present-day Zaragoza) and Alaun (Alagón) for a water canal that the former wanted to build. Both parties accepted the arbitration of the Contrebia Belaisca senate who ruled in favour of Salduie.
7. Fanlo Loras, Antonio, "La gestión del agua en España: Experiencias pasadas retos futuros", *Redur* No. 0 (2002), Logroño.

8. Arrojo Agudo, Pedro, "La gestión del agua en España ¿De dónde venimos y a dónde vamos?", *Dossier de La Vanguardia*, Barcelona, 2006.
9. Directive 2000/60/CE, transposed in Spain through Law 62/2003, 30 December 2000, *Medidas Fiscales, Administrativas y del Orden Social (Fiscal, Administrative and Social Order Measures)*.
10. Available on FCAS' web site: <www.fcas.es>.
11. Royal Decree 822/2008, 16 May, by which the Spanish Cooperation Fund for Water and Sanitation Office was created, published 25 June, 2008 in the Spanish Official Bulletin of the State.
12. The possibility of granting non-binding loans is also considered; to date only non-refundable aid has been provided.
13. Available on FCAS' web site: <www.ofcas.es>.
14. *Plan Director de la Cooperación Española 2009-2010*, Ministerio de Asuntos Exteriores y de Cooperación, Secretaría de Estado de Cooperación Internacional, Dirección General de Planificación y Evaluación de Políticas para el Desarrollo, Madrid 2009.
15. *Ibid.*
16. Royal Decree 1460/2009, 28 September, on organisation and running of the Spanish Cooperation Fund for Water and Sanitation, published 29 September in the Spanish Official State Bulletin.

