TACKLING THE WORLD WATER CRISIS: RESHAPING THE FUTURE OF FOREIGN POLICY

Edited by Josephine Osikena
and Dr David Tickner

With forewords by Baroness Catherine Ashton
and Rt Hon William Hague MP

The Foreign Policy Centre

Nestlé
Good Food, Good Life

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The Foreign Policy Centre

The Foreign Policy Centre (FPC) is an independent, London-based foreign affairs think tank. Established in 1998 by the then Foreign Secretary, the late Rt Hon Robin Cook MP, the FPC was developed to inject fresh thinking into foreign policy debate and analysis through cross-party engagement in order to promote a progressive and multilateralist approach to global affairs. The FPC has three Co-Presidents: Rt Hon Michael Gove MP, Secretary of State for Education; Baroness Margaret Jay, former Leader of the House of Lords; and Rt Hon Charles Kennedy MP, former Leader of the Liberal Democrats. The Centre operates as a global network with a diverse range of projects and programmes and aims to develop innovative policy ideas which popularise practical solutions to global challenges. This is carried out through the Centre's research and publications, as well as a rich and diverse programme of events. Further information can be found at www.fpc.org.uk.

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Contents

Foreword

Baroness Catherine Ashton
High Representative of the European Union for Foreign Affairs and Security Policy and Vice President of the European Commission

Water is indispensable for our daily consumption and hygiene, domestic use, and a range of economic and cultural activities. As eternal, as the beginning of the history of mankind, water availability has been a determining factor in the subsistence and prosperity of society through its evolution from communities to nations and states. We find that many of the first great civilisations emerged along the large valleys of the Nile, the Indus, the Yellow River and the Tigris and Euphrates. Irrespective of whom we are and where we live, water is our basic need and entitlement.

Such universal entitlement is indisputable, but still a far cry from today's reality. Globally available freshwater is finite, shrinking, unevenly allocated and often poorly managed. These circumstances lead to a lack of access to safe drinking water for a fifth of the world's population. The challenges of climate change and population growth are expected to aggravate the current imbalances in water availability. To avoid an escalation of the problem, responsible approaches need to be adopted by consumers, the private sector, civil society and decision-makers – locally, nationally and internationally.

The 263 water basins that cross national boundaries affect close to 150 countries. Discussions on water and water resource management are inherently part of their neighbourly interactions. Despite the ever-changing geopolitical scene, in most parts of the world, water has always been a key aspect of external policy. There are numerous examples of water disputes that have arisen over restrictions or pollution. In the Middle East, for example, where the EU is working to support a peace deal between Israel and its neighbours, water is one of the vital issues on

which all neighbours need to agree. Without this, lasting peace simply will not be possible. Borders, security and displaced people – are core issues linked to the question of water. Even in the case of an individual country, water can cause internal tensions and difficulties. Take Yemen: its capital city Sana'a may run out of water supplies by 2017. This threatens the development of agriculture and industry. It also poses a threat to internal stability as tensions over access to water raise a serious risk of conflict.

On the positive side, history suggests that water cooperation and peaceful conflict resolution by far outnumbers incidents of water conflicts.

It is illustrative that the oldest extant international organisation was brought to life in the early 19th century to govern navigation on the Rhine. Subsequent transboundary water treaties and agreements concluded mainly during the 20th century have often extended to water allocation between states and even to the joint management of internationally shared waters. Such examples can be found around the world and concern many of the most significant and strategic shared river basins, including those of the Mekong, the Senegal River, the Jordan River, the Danube and the Rio Grande. Concluding some of these agreements took decades. They have nonetheless proven themselves to be worth the political investment, both for the promotion of core water-related objectives and also for softening the often deep demarcation lines of official interstate politics.

We should listen to what history teaches us: there are superior causes that transcend any political interests. Water is such a cause.

Baroness Catherine Ashton
May 2010

Foreword

Rt Hon William Hague MP
Secretary of State for Foreign and Commonwealth Affairs

Water security is not simply an environmental and development concern, but an urgent foreign and national security concern. It is an issue which has risen rapidly up the political agenda and for good reason: it is predicted that in a mere 15 years time, by 2015, nearly two-thirds of the countries on earth will experience some form of water stress.

Exacerbated by the simultaneous effects of climate change and population growth, water shortages have the potential to threaten the peace, prosperity and stability of our world. We do not have to wait 15 years, for they are already doing so now. In the Middle East, one of the world's most volatile regions, five per cent of the world's population share one per cent of the global water supply. Disputes over limited water supplies between Israel and her Arab neighbours have taken place for decades and countries such as Iraq, Syria, Jordan and parts of Turkey and Lebanon are currently suffering from acute drought.

Heightened competition between countries over water resources also has implications for the balance of global and regional power elsewhere. Ten countries in East Africa, with a combined population of 180 million people, share water from the Nile Basin. Seven of these have experienced some of the most brutal conflicts the world has witnessed in recent years, such as the Democratic Republic of Congo, Kenya, Rwanda and Sudan. In western Himalaya, the Kolahoi glacier exists as the only water supply for the Kashmir valley, historically an area of tension between Pakistan and India, both nuclear powers. It is melting at an alarming rate and its disappearance could potentially damage the livelihoods of millions of people and precipitate their displacement. Intense diplomacy and negotiation will be required to overcome

complex and incendiary disputes over scarce resources such as water in the Kashmir valley, and in other areas dogged by conflict, instability and poverty around the world.

The year 2015 also marks the deadline for achieving the Millennium Development Goals (MDGs). One of the eight goals is to halve the proportion of the global population that currently lives without sustainable access to safe drinking water and basic sanitation. According to the latest UN report on progress to date, "Steep challenges remain in meeting the sanitation target" and whilst "the world is well on its way to meeting the drinking water target", "some countries still face enormous challenges". Access to safe drinking water is a basic human right and it is in the interest of our collective security to ensure that every effort possible is made to meet this particular MDG.

I welcome the publication of this collection of essays. They have been written by experts in their fields and I believe they will be a valuable source of information, analysis and ideas. The challenge for us all is to keep water security at the forefront of our thinking with the joint international forces of governments, businesses, academia, and non-governmental organisations working alongside one another. I am sure this publication will contribute a great deal to the debate.

Rt Hon William Hague MP
May 2010

Introduction

Why water? The impact of hydrological realities on foreign policy in the 21st century

Josephine Osikena, The Foreign Policy Centre and Stephen Twigg MP

> *"It is my hope that by making water a front-burner issue, a high priority in our national and international dialogues, we can give our children and our children's-children the future they deserve."*[1]
>
> Hillary Clinton, US Secretary of State
> Washington DC, March 2010

Why water? Why now?

Today, the earth's environmental resources are increasingly under enormous strain. Nowhere is this stress more apparent than in the case of the earth's finite supplies of freshwater. Less than three per cent of the earth's water is potable and 2.5 per cent of this freshwater is inaccessible, locked up in Antarctic and Arctic ice sheets and glaciers. The vast majority of freshwater that is accessible is secured through ground water sources, rainfall and natural lakes. In addition, fewer than 10 countries hold 60 per cent of the world's available freshwater supplies: Brazil, Russia, China, Canada, Indonesia, U.S, India, Columbia and the Democratic Republic of Congo[2].

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1 Clinton, Hillary Rodham (March 2010), World Water Day, National Geographic Society, Washington, DC, state.gov/secretary/rm/2010/03/138737.htm

2 World Business Council for Sustainable Development (August 2009) *Facts and Trends; Water Version 2* wbcsd.org/DocRoot/ID1tMGiLZ7NL9mBOL2aQ/WaterFactsAndTrends-Update.pdf

Two striking global trends have increased the urgency of addressing water management issues as an unfolding global security challenge. First, there is the impact of climate change and its impact on global freshwater supplies. Dr Gordon Conway, the former Chief Scientist to the UK Department for International Development (DfID) describes the principle dilemma created by global warming as a problem of "too much or too little water[3]." Water not only ensures the survival of people and the natural environment, but it is a critical resource for regulating the earth's temperature. Second, variations in the earth's climate are compounded by the challenge of tackling the world's explosive population growth which has ushered in changing consumption (and production) habits, particularly in middle income countries where meat consumption is high and on the rise. These factors have culminated in a surge in demand for limited freshwater reserves. In 2009, the world's population stood at 6.8 billion, an increase of over 80 million from the previous year. By 2025, the global population is projected to increase to a staggering 8.1 billion[4].

Is there any wonder then, that water issues are now increasingly making news headlines? This year alone, two special reports have been published by the Financial Times, one focused on waste and water management and the second on the future of cities. Both reports explored the challenges of tackling access to freshwater supplies in an age of growing scarcity. In addition, only recently the Royal Academy of Engineering published a report on global water security and, the Economist has recently published a special issue dedicated to water.

Much like the uncertainties and insecurities produced by other global challenges – such as health pandemics, the international narcotics trade, terrorism and conflict across (as well as between) regions and communities, population growth, the vulnerability brought about by the volatility in food, fuel and financial markets, or indeed the impact of climate change – almost perversely, water scarcity also shares similar qualities to global public goods. In essence, the benefits – or lack

3 Toulmin, Camilla, Climate Change in Africa (2009), London, book launch, November 2009, Royal African Society et al
4 Population Reference Bureau 2009, World Population Data Sheet (2009) prb.org/pdf09/09wpds_eng.pdf

thereof – produced by such uncertainties, insecurities and scarcity extend beyond national borders, generations and population groups, albeit in different ways. In addition, without decisive collective action, access to freshwater will become increasingly limited and the growing risk of water scarcity more widespread.

Yet water, which is such an integral part of the planet's social, economic, political and environmental wellbeing, has for too long been overlooked as a major cause of global uncertainty and insecurity. This is despite the fact that its increasing scarcity has led to a crisis, which although many argue is preventable, continues to be ignored, and as such stores up foreign policy dilemmas which have thus far lacked the sufficient strategic policy analysis, discussion and debate that such an unprecedented challenge merits.

How can access to freshwater be secured when and where it is needed, and how can the competing demands for freshwater from the environment, agriculture, industry and households be more effectively managed? More importantly, in an increasingly interconnected world where co-operation is not just an option but an absolute imperative, how can future foreign policy tackle the challenges thrown up by the world water crisis?

The big tent

As an international affairs think tank, the Foreign Policy Centre has always been keen to explore how foreign policy is being shaped by many of the issues transforming the world today and it is for this reason that the FPC embarked upon pulling together current thinking through a collection of short essays exploring the interface between world water scarcity and how these challenges might reconfigure the global foreign policy agenda.

In order to achieve this, the FPC engaged with a range of academic and environmental experts, practitioners and specialists from across the water sector. Beyond this however, we also recognised the importance of bringing together strategic decision-makers from a host of arenas, including: the UK Parliament, the European Commission, international development organisations,

multilateral agencies and business, as well as the print and broadcast media. Thanks to the dedication and commitment of the contributory authors, this publication seeks to provide a blend of styles, approaches and perspectives exploring the significance of the world water crisis and its impact on today's foreign policy agenda. While the ideas developed in the essay collection do not claim to provide an exhaustive analysis of all the potential foreign policy impacts created by water scarcity, what the collection does aim to do is provide a platform for a diverse range of voices, all of whom have endeavoured to explore some of what they believe are the most significant issues, in an effort to give water much more prominence in today's global foreign policy. It is worth noting however, that the views expressed in each essay are those of each respective author and do not necessarily reflect the views of the FPC or the other organisations associated with this project.

Overview – The big ideas

The essay collection reveals three overarching themes. The first relates to the centrality of water in tackling 21st century challenges such as peace, food and energy security as well as safeguarding sustainable livelihoods in poor regions and countries.

Section one

In the first section, entitled 'Nine billion people in a boat: Security and development in a thirsty world,' Dan Smith, Secretary General of the peace building organisation International Alert and Chair of the Advisory Group for the UN Peacebuilding Fund, explores the nexus between water, peace and security. Dan argues that while potential disputes over shared water resources may not have produced outright conflict, tension is masked by cooperation between unequal powers which can fuel social and political instability and violence within and between states. All of this he argues is compounded by climate change. This is particularly the case in high risk regions such as Darfur, Yemen, Nepal and Bangladesh where the effects of too much (floods) or too little (droughts) water are testing peoples' resilience and ability to adapt. Dan concludes that good water management is an important part of peacebuilding and can only be delivered through insightful political leadership.

Bernice Lee, Research Director for Energy, Environment and Resource Governance, and her colleague Lucinda Ellinas at Chatham House, the international research institute both examine the inextricable link between energy and water. Water cannot be secured without employing energy and energy cannot be produced, transported or distributed without water. Bernice and Lucinda analyse the implications for securing affordable, reliable and sustainable access to scarce natural resources such as water. The interdependence of energy and water is discussed in the context of a world confronted by an age where natural resources have becoming increasingly scarce due to pressures from the explosive growth in the earth's population, as the world becomes rapidly industrialised and urbanised under increasingly acute climate constraints.

Dr Bruce Lankford is Senior Lecturer in Natural and Water Resources at the University of East Anglia. He highlights the importance of irrigated agriculture in improving food security and water management. Bruce also provides an insightful manifesto for irrigation to produce more food with less water.

Dr Camilla Toulmin, Director at the International Institute for Environment and Development (IIED) and Jamie Skinner, IIED Principal Researcher discuss the interconnectedness of water security, climate change and farmers' livelihoods in the Niger River region where the availability of water is not necessarily scarce, but the effective governance required to make the most optimal water management investment choices is.

Section two

The opening section provides an important launch pad from which to base the second overarching theme, which focuses on governance and investment in water management. In section two entitled, 'A river runs through it: The economic imperative for managing water wisely,' Professor Tony Allen of King's College London and the School of Oriental and African Studies (SOAS) questions whether international trade in food commodities can deliver food and water security for the rural and urban poor and whether this process improves their access to international markets and ultimately provides an exit out of poverty.

David Nussbaum, Chief Executive of WWF-UK, analyses why water scarcity has particular relevance to big business. He discusses the uniqueness of water as a natural and irreplaceable resource that is impossible to substitute, underlining the shared and differentiated risk and responsibility required by business and other water users to mitigate and adapt to the global water crisis. David outlines the business case for private sector investment in a new approach to water stewardship which looks beyond volumes of water used to consider the impact of water use on natural and economic systems. This approach supports the development of an appropriate equitable and transparent regulatory framework to help allocate water to different users. In addition, this model also aims to develop industrial and farming practices that enable more to be done with less water. Above all however, the stewardship ethic posed by David demands strong and autonomous political water management institutions that not only have the technical capacity to secure greater outputs for every litre of water used, but can also rigorously enforce fair and sustainable water allocation for all.

Dr Martin R Stuchtey, a partner in the Munich Office of McKinsey & Company, a global management consultancy, provides an essay outlining the economics of water management. Martin's essay is based on the 2009 report entitled, '*Charting our water future: An economic framework to inform our decision-making*.[5]' This publication was produced by the 2030 Water Resource Group . Martin maps out a blueprint for action by arguing that new and affordable investment strategies (particularly in agriculture) are needed to enable water users to increase water productivity, allowing much less water to go a lot further.

Section three

The third and final section entitled, 'Nor any drop to drink: Water and habitats for people and nature' provides a collection of essays that aims to raise two important

5 Established in 2008, the 2030 Water Resource Group aims to foster the development of innovative insights into the critical issue of water scarcity. Group members include the International Finance Corporation (IFC), McKinsey & Company and a business consortium which include many well known global brands. 2030 Group (2009), 'Charting Our Water Future: Economic frameworks to inform our decision-making,' mckinsey.com/App_Media/Reports/Water/Charting_Our_Water_Future_Exec%20Summary_001.pdf

issues. The first is to highlight the importance of the diverse social groups who, despite being central to the water scarcity debate, are often marginalised.

Fiona Harvey, Environment Correspondent for the Financial Times examines those who lack adequate access to drinking water and sanitation facilities. She argues that the impact of improving the provision of safe drinking water and appropriate sanitation facilities in poor countries is a cornerstone for economic development transformation. This not only has a direct influence on the provision of many essential social services including health and education, but it also influences an economy's productive capacity in terms of the number of working days lost to sickness. Fiona explores why water and sanitation has failed to acquire the political and policy attention they deserve. She also asserts that while controversy surrounding public and private sector provision of water and sanitation is complex, such issues should not be allowed to hijack the debate when improving provision for those most in need is the urgent challenge.

Belinda Calaguas, Director of Policy and Campaigns at ActionAid, examines the central role women play in tackling the crisis in water management. She also questions why the issue of women's rights is often conspicuously absent from water management decision-making. Belinda helpfully outlines a number of recommendations to address this deficit, in order to enable women to have a greater voice commensurate with their knowledge and expertise as primary users of water resources in many communities around the world.

Dr Letitia Obeng, Chair of the international Global Water Partnership (GWP) network, and her colleagues, Dr Akiça Bahri and Dr Ania Grobicki, analyse the realities of water scarcity in the sprawling megacities that have sprung up across the developing world. The authors conclude by outlining an agenda for action to help achieve better sustainable water management in emerging urban areas.

The second important issue highlighted in the third section is to look beyond water itself in order to address the importance of rivers and aquifers. Richard Black, the BBC News Environment Correspondent discusses how nature is being

squeezed by people's increasing demand for freshwater and against a backdrop of ever-dwindling supplies. In essence, Richard examines the impact of water scarcity in keeping species and natural systems intact, through preservation and restoration as opposed to exploitation beyond redemption.

In addition to the essay authors, the FPC is grateful to both Baroness Catherine Ashton, High Representative of the European Union for Foreign Affairs and Security Policy and Rt Hon William Hague MP, UK Secretary of State for Foreign and Commonwealth Affairs for supporting this project by providing forewords for this publication. The FPC also owes a huge debt of gratitude to Dr Dave Tickner who leads the Freshwater Programme at WWF-UK. Dave has provided invaluable co-editing assistance. Finally, the publication could not have been delivered without the ongoing support provided by Anna Owen at the FPC or the financial support of Nestlé, one of the Centre's long-standing corporate members.

SECTION ONE
NINE BILLION PEOPLE IN A BOAT: SECURITY AND DEVELOPMENT IN A THIRSTY WORLD

Water, peace and security

Dan Smith, International Alert

Water is a basic condition for life. We depend upon it for daily use, agriculture and industry. Declining availability or quality of water undermines welfare, impairs human security and generates risk of conflict. And unfortunately, an excess of water can have the same effects.

In recent years, there have been two commonplace statements about the link between water and insecurity. Both have attained a level of cliché. Like many clichés they contain elements of the truth salted with a great deal of imprecision.

Conflict and cooperation

The first view is that the wars of the future will be about water rather than oil. The aridity of many oil-producing regions adds to this insight's vividness and urgency.

However, the second is that so far, there have been very few violent international conflicts over water. The potential for disputes over shared water resources such as trans-border rivers and lakes has more often led to cooperation than outright conflict.

If this second insight vitiates the first, several points should be added. To begin with, some of the cooperation is between unequal powers; in these cases, the agreements are unfair to one side, but it had little or no choice but to accede to the agreement because of the much greater power of the other party. Cooperation thus masks these conflicts rather than offering a genuine resolution.

The effects of climate change

The key to understanding the human and social impact of climate change is water – too little of it or too much, in the form of drought or floods, or simply a changed

timing, as with the monsoon in Nepal, or a changed location, as with the shifting pattern of typhoons in the Philippines.

The unfolding effects of climate will increase water scarcity, both long-lasting drought and seasonal variation. This reduces livelihood security. Crop yields decline. At the extreme, even a rich country like Australia has lost its rice producing capacity. In South and Southeast Asia, climate change threatens rice production in the long term with potentially catastrophic economic and human consequences.

When basic components of human security are threatened, evidence shows that one result is increasing pressure on increasingly stressed government structures. People need a responsive state to respond to their needs. When it cannot, conflicts over a narrowing resource base cannot be resolved. This produces social conflict and political instability. As pressures increase, violence may escalate into open armed conflicts. And instability and violent conflict within states may feed instability and conflict between states.

Migration

One reaction to the pressures is migration. A government strategy paper in Bangladesh foresees 20 million people displaced over a 20 year period as coastline is lost due to the consequences of climate change. The paper does not say what can be done with 20 million migrants – people leaving their homes at an average rate of one million people a year.

In Bangladesh, migrants from the delta – leaving not because coastline is lost but because tracts of land further up the delta are periodically lost as the river changes direction – have traditionally gone to three places:

- to northeast India, where low level conflicts have ensued, and from which the Indian government is trying to block them with a physical barrier;
- to Dhaka, recently rated by the Economist Intelligence Unit as co-equal second least liveable city in the world – with only Harare exceeding it in awfulness;

- and to the Chittagong Hill Tracts, where pressure from incoming Bengali settlers led to a prolonged civil war with the hill people, ended by agreement in 1997, but with tensions continuing to simmer and possibly already close to boiling point – there was a major outbreak of violence in February 2010.

The experience of Bangladesh stands as an illustrative warning about the chain of consequences from carbon emissions through climate change via migration to conflict, instability and rampant insecurity.

Because of the state of the immigration debate in Europe, several points bear emphasising. In the climate-migration chain of consequences, many of the links are impossible to quantify. Extreme figures – such as predictions of one billion climate migrants – lack credibility at this stage. The scale of migration will build slowly rather than in a sudden flood reminiscent of refugees from a war zone. It may often be difficult to distinguish climate from economic opportunity as a factor motivating migration, most of which, as in the Bangladesh case, will be about people moving within the country or to neighbouring countries.

High risk regions

In many regions, changing conditions of water supply could provoke instability, conflict and violence. Long term drought was one of the background issues in the Darfur conflict. The current unprecedentedly long drought in Afghanistan weakens the foundations on which stability might be built.

The highest risk regions for insecurity of water supply in the coming 10-20 years include:

- the Sahel and Sahara;
- the Ganges-Brahmaputra river system in Nepal, Bangladesh and northeast India;
- the Nile Basin involving 10 countries from central Africa to the Mediterranean;
- the Mediterranean littoral as a whole;
- the Arabian peninsula and especially Yemen, which has been depicted as the first country likely to run out of water;

- the Mekong Delta;
- and Peru because of the melting of the Andean glaciers on which it primarily depends for fresh water supply.

Water and peacebuilding

It follows from the link between water insecurity and more generalised human insecurity that good water management is part of peacebuilding – both in preventing countries from lapsing into violent conflict, and in helping them not relapse after a period of armed conflict. Equally, peacebuilding is a part of good water management.

The Koshi River flows through the southeastern Terai region of Nepal. It flooded in summer 2008 displacing more than 60,000 people. The river embankment is fragile in many places and an even greater area faces a severe risk of flooding. This is closely linked to the poor maintenance of river barrages. Responsibility thus ultimately lies with the government.

In 2008, an Indian firm was contracted to repair a major barrage on the Koshi river. The work was held up by labour disputes that the firm could not settle because of the rivalries between the unions, linked to rival political parties. Nor was it possible to get the district authorities to resolve the issues. And the central government lacked the capacity to step in and assert control. And because the barrage was not repaired, it broke.

This is a conflict issue because of tensions in the Terai. Scores of small armed groups are active in the Terai. Some are purely criminal, others are partly political, feeding on resentment that the peace accord that ended the Maoist insurgency in 2006 marginalised the people of the Terai.

Failure to act in 2008, despite good intentions and proper planning, fed resentment and instability. This makes it harder to act the next time round. The real question is not whether the problem begins with climate or politics, because it begins with both; the real question is what to do about it.

And the state

The challenge of managing the Koshi and other comparable challenges arising from or exacerbated by the consequences of climate change requires the framework of a well functioning state. An effective river-management scheme would reduce the discontent caused by the massive socio-economic consequences of flooding. In the case of Nepal, this is only possible if the political parties cooperate, suspending rivalries in the name of the people's interest.

This would both achieve the immediate desired effect of flood prevention and increase confidence in the political process in general. This in turn would lubricate other crucial peacebuilding and state-building tasks.

The issue of climate is thus an issue of peace and of governance. It requires an approach to state-building that, like peacebuilding, emphasises participation of citizens and the mobilisation of social resources. Building resilience cannot be done by top-down, arbitrary proclamation. Nor can it be done if resources for adaptation projects are diverted into the pockets of a narrow elite.

Much of the discussion today – especially the discussion about how much money must be stumped up to finance adaptation – emphasises large infrastructure projects. It more or less ignores the reality that resilience will be built by many people undertaking small projects, such as changing crop rotation and selection or responding to altered building regulations.

To achieve this, people must know and understand what is required, and for this they must trust the message and the messenger. When societies are able to digest and disseminate complex and challenging information and respond to it by undertaking major changes, they are in the process of building states that are responsive, inclusive and legitimate – and therefore stable.

The effects of climate change on water supply offer huge, inter-related challenges. They also offer multi-dimensional opportunities for progress. The quality of political insight and leadership will determine which track will be followed.

Water and energy security: A double-edged sword

Bernice Lee and Lucinda Ellinas, Chatham House

Global climate change and the resource crunch underlie many of the risks and uncertainties confronting the global community today. The anticipated bottlenecks and constraints – in energy, water and other critical natural resources and infrastructure – are bringing new political and economic challenges, as well as new and hard-to-manage instabilities. These new resource risks are unfolding at a time when there is a range of socio-economic pressures created by rapid industrialisation and urbanisation, especially in emerging economies. Meanwhile, water-related environmental change – whether extreme weather events, water shortages, changing sea levels or melting glaciers – will generate new threats to critical infrastructure that underpins traditional energy production and delivery systems. Cleo Paskal, in her new book *Global Warring*[1], persuasively describes the impacts of environmental change already underway on energy generation and infrastructure.

The generation of energy and potable water are intractably bound. In the coming decades, managing the efficient use of shared water and energy resources will be central to peace and prosperity in many regions, whether in Central Asia, the Middle East or beyond.

Energy is essential for obtaining water – to extract fresh water from underground aquifers and for its transport. It is used to manage and treat impaired water for re-use, and to desalinate brackish and sea water to provide new potable water supplies.

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1 Cleo Pascal, *Global Warring: How Environmental, Economic, and Political Crises will Redraw the World Map* (New York, NY, Palgrave Macmillan, 2010)

Extensive use of desalination will be required to meet the needs of a growing world population[2]. The diversion of national energy resources for desalination will be an issue for several Middle East and North African countries as the effects of industrial and agricultural practices, population pressures and climate change erode groundwater resources. The Emirate of Abu Dhabi, for example, has one of the highest per capita levels of residential water consumption in the world and almost all of this is desalinated.[3] Saudi Arabia relies on desalinated water for about 70 per cent of its needs and this is growing.[4] It is often not desalination that consumes the most energy, but the pumping process itself from the sea to urban areas. This will add to the pressure on countries such as Yemen, whose energy systems are weak and inefficient and whose economies are dependent on exporting their oil and gas resources. These challenges are driving interest in alternative technologies. Kazakhstan, India and Japan have all used nuclear desalination and several other countries including China, Egypt and Libya, are considering it. Saudi Arabia commissioned its first solar desalination power plant earlier this year.

Meanwhile, many energy options are dependent on a bounteous supply of water – whether in hydropower, the cooling of thermal power plants, fossil fuel production and processing, biomass production or hydrogen economy.

Energy production and water

Today, energy production accounts for approximately 39 per cent of all water withdrawals in the US and 31 per cent in the European Union[5]. During Europe's record-breaking heat wave of 2003, temperatures across the continent reached more than 104 degrees Fahrenheit and as a result, 17 French nuclear reactors had to power down or be shut off, at a time of heightened demand due to the greater use of air conditioning. This cost the public energy provider Électricité de France (EDF) approximately €300 million[6].

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2 Roberto Vigotti (REWP) and Allan Hoffman (US DOE), *Water Scarcity and Water Security: Political and Social Implications*, (March 2009), iea.org/work/2009/rewp_water/Vigotti.pdf

3 Aquastat, FAO's Information System on Water and Agriculture: fao.org/nr/water/aquastat/countries/untd_arab_em/ index.stm

4 Saudi Arabia Market Information Resource (SAMIRAD): saudinf.com/main/a541.htm

5 Lloyds.com/News Centre, *Water scarcity and future business risks*, (15 April 2009), lloyds.com/News_Centre/Features_from_Lloyds/News_and_features_2009/360/Water_scarcity_and_future_business_risks.htm

6 Cleo Pascal, *Global Warring,* (New York, NY, Palgrave Macmillan, 2010) p. 57

Expendable water is also a necessary condition for hydropower – the most widely-used renewable source of energy representing 19 per cent of total electricity production. Canada is the largest producer of hydroelectricity, followed by the US and Brazil. Approximately two-thirds of the economically feasible potential for hydropower is yet to be developed, particularly within Latin America, Central Africa, India and China,[7] though much of this will not be exploited due to its environmental and social impacts. Today, many hydropower plants have not been designed to incorporate environmental change-induced site variations. Many, for example, are dependent on increasingly unpredictable seasonal precipitation. Between 2008 and 2009, hydroelectricity generation in India declined by almost 8.5 per cent relative to the previous year. The loss was blamed on inadequate rainfall[8]. In principle, the use of the water is non-consumptive in hydropower – as water is returned and reused. However, huge losses occur through evaporation from reservoirs. The total reservoir evaporation from the 22 countries of the Mediterranean Action Plan is estimated to be approximately 24km^3 per year – equal to nearly the total annual water use of Argentina[9].

Reactors in nuclear power plants also require a substantial amount of water or air for cooling. As a result, they are often located on the coast, making them vulnerable to sea level rises and extreme weather. Reactors are also located on rivers, lakes or reservoirs and are therefore dependent on increasingly unpredictable freshwater supplies. Planning for site security is therefore vital.

Bioethanol, predominantly produced from sugarcane and maize, provides yet another example of water-energy interdependence. Increased agricultural production to produce sufficient quantities of biofuels demands that water will have to be diverted from elsewhere: an average of 2,500 litres of water is required to produce one litre of biofuel.[10]

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7 UNESCO, World Water Assessment Programme, *Water and Energy,* unesco.org/water/wwap/facts_figures/water_energy.shtml
8 Cleo Pascal, *Global Warring*, (New York, NY, Palgrave Macmillan, 2010) p. 56
9 UNESCO, 3rd UN World Water Report, Water in a Changing World, 2009. p.116 Blue Plan, MAP, and UNEP 2007
10 UNESCO, 3rd UN World Water Report, 'Water in a Changing World', 2009, p.111.

Oil, coal and gas resources are predominantly located below groundwater levels. The drilling process in extraction can, on occasion, penetrate the partition between the fossil fuel and essential groundwater reserves. Controversy around the Canadian oil sands provides a good illustration of the resource dilemmas surrounding these 'new' energy sources.

The oil sands operations require large quantities of water which can become contaminated. Once the oil is removed, a mixture of water, sand, clay and residual bitumen (tailings) remains and this contaminated water is stored in cast tailing ponds while the solution settles and separates. These toxic ponds are intended to prevent contamination of groundwater and river systems. There are however, doubts as to the reliability of such systems as these ponds are leaking into the surrounding groundwater and Athabasca River. Looking to the long term, Canadians fear that if operations cease in these areas or oil runs dry, the companies will no longer be obligated to maintain the facilities. In addition, surface contamination can occur during transportation and storage – a number of notorious oil spills have highlighted these risks.

Similar concerns have been raised about shale gas development in the US – especially over the impact on water quality of the chemicals used in hydraulic fracturing processes. The US Environmental Protection Agency (EPA), for example, expressed concern about the potential risks associated with gas drilling activities in the New York City watershed and the reservoirs that collect drinking water for its nine million inhabitants. The nature of fluids used in the hydraulic fracturing process would need further investigation.

Another example is coal to liquid (CTL) technology, which requires approximately 10 gallons of water per gallon of CTL product. For the US to meet provisions outlined for this technology, the States would have to source an additional 210 billion gallons of water annually[11].

11 Jeff Logan and John Venezia, World Resources Institute, *Coal-To-Liquids, Climate Change, and Energy Security* (13 May 2007), wri.org/stories/2007/05/coal-liquids-climate-change-and-energy-security

In short, the development of new energy resources – as with the current resources that they seek to replace – comes with material, environmental and security risks. These maybe of a less immediate or obvious nature, but nevertheless need to be considered within the risk assessment of new technologies. These include risks around general resource use – particularly if there is an impact on water or land use.

There are also significant implications for energy and water prices. Potential disruptions in the water sector – whether due to lack of foresight in plant locations, the impact of heat waves or droughts, etc – may impact further on the cost of energy production. Rising insurance costs can endanger the economic security of investment and, if perceptions of increasing water scarcity persist, potable water also has the potential to soar in value. This means that the cost of energy is also likely to increase.

Managing future resources

The interdependence between water and energy, coupled with increasingly limited availability, poses a major global dilemma. More countries will become dependent on desalinated water, effectively pushing up the cost of water; this will be largely subsidised by governments, leading to a lack of incentives for water investment and user efficiency. Inequity will be sharpened between those countries that can afford both the energy and desalination technology and those that cannot.

With energy production forecast to grow by approximately 40 per cent over the next two decades, water consumption for energy production is set to more than double over the same period[12]. Industry and power generation will also feel the effects of water stress, most directly in the hydropower sector but also in nuclear and thermal power stations reliant on water coolant systems and in a wide range of manufacturing industries.

12 Ibid.

Demographic factors and consumption patterns are also likely to play a continuing role in exacerbating pressure on both water scarcity and energy security. If a pending water crisis is allowed to culminate, the world will be faced with insufficient energy generation and soaring costs, making the production of potable water yet more economically challenging. Political tensions over access to land and water rights is already evident in countries like Sudan and Kenya. Managing these tensions will not be easy.

Decisions on energy production, transportation and use today will shape the potential contribution and availability of resources like water in years to come. Tackling the challenges thrown up by the water-energy nexus in a collaborative manner – including issues of trans-boundary sharing or trade – is key to a sustainable future to secure water, climate and energy security for all.

Improving irrigated agricultural productivity in an age of food and water scarcity

Dr Bruce Lankford, University of East Anglia

Introduction

This essay describes the pivotal position that irrigated agriculture plays within a globalised food system. It explains the scale of water use and food production linked to irrigated agriculture and highlights the underlying complexities and challenges that society faces as we consider how to increase food security through improved water management.

Putting the numbers into perspective

To put water and crops – or water scarcity and food security – in perspective, we can start by observing that most crops require, per hectare, approximately 150 kilograms of potassium and 150 kilograms of nitrogen in one growing season, but about 5,000-8,000 tonnes of water. This water (which passes from roots to transpire from plant leaves) must be provided either by rainfall, by shallow groundwater, by irrigation, or by a combination of all three. The numbers quickly add up. Ten thousand hectares of rice require about 120 million cubic metres of water for one four month season (equivalent to a storage body of about 50 metres depth by 1.5 km^2.) Moreover, we can use a simple rule of thumb; the amount of water required for one hectare of irrigation in hot climates is about one litre per second every second of the day. This means an area of 10,000 hectares requires about 10,000 litres per second during the peak requirement period. And to put this in perspective, the larger urban area of Bristol with about 10,000 hectares (10 km^2) and one million inhabitants uses about 20 per cent of the irrigation demand for an equivalent area (using a per capita use of 170 litres per day.)

Worldwide, agriculture evapotranspires approximately 20-25 cubic kilometres per day and the 270 million hectare irrigated component of this evaporates daily about 6-8km^3 per day of water globally[1] (global withdrawals for urban and domestic use are approximately 10 per cent of this[2].) About 70-80 per cent of freshwater abstracted from rivers or aquifers in the developed world is used for irrigation – as a result of the areas involved situated in hot, semi-arid or semi-humid climates (in cooler, temperate Britain only 2-3 per cent of freshwater is consumed by irrigation.) We can now see why irrigation places stress on tropical or sub-tropical river basins more than climate change and why uneven consumption within river basins can be a source of water conflict. Temporary or long term water shortages concern many communities and countries that share rivers: from the local scale where irrigators attempt to close down neighbouring irrigation intakes, to the national scale where the 10 countries that share the Nile Basin attempt to table discussions on new volumetric apportionments.

Food security and food productivity

Irrigated agriculture provides about 40 per cent of the world's food[3], including nearly all rice which is a key grain crop for billions of people living in Asia. Other key foodstuffs include fruit and vegetables and increasing amounts of meat via irrigated pasture. Irrigation thus underpins many agro-industrial economies and provides livelihoods for millions of farmers and secondary producers.

Furthermore, irrigation is believed to 'waste' significant amounts of water that might otherwise be used to extend agricultural lands or be allocated to other uses – for example, wetlands and other environmental flows. Although there are significant misunderstandings about the science of water waste and savings (often 'waste' water is not actually wasted as it is collected for downstream use), most scientists agree that productivity can be significantly boosted by using water in a

1 See Food and Agriculture (FAO) Aquastat website: fao.org/nr/water/aquastat/main/index.stm

2 CAWMA (Comprehensive Assessment of Water Management in Agriculture). 2007. Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture. London: Earthscan, and Colombo: International Water Management Institute.

3 Schultz, B, Thatte, C.D. and Labhsetwar, V.K. 2005. Irrigation and drainage. Main contributors to global food production. *Irrigation and Drainage* 54 (3).

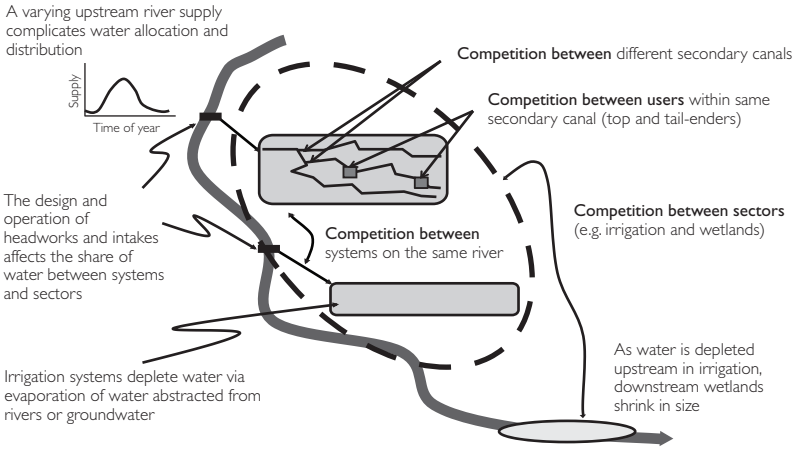
more careful and timely manner. The author estimates that productivity can also be increased by 25-30 per cent by refining existing technologies and practices, including better irrigation scheduling.

Irrigation familiarity and complexity

The great policy risk is to oversimplify our approach to irrigation by relying on an incomplete perspective. Some see irrigation as an agronomic act of bringing water to crops (rather like adding fertiliser.) Others view it as a cultural landscape (think of the terraces of Bali.) Others perceive it to be 'infrastructure' (canalisation is not too dissimilar to rural roads), whereas others view it as part of precision agriculture (akin to computer-aided seed drilling.) To yet others, irrigation is a social undertaking with user associations and rules of use but where the engineering side, being 'technical' is of no interest. Frequently, it is an arena where inefficiencies are commonly invoked, but in response, small is deemed beautiful (farmer-managed systems), smaller is even more beautiful (e.g. bucket kits) and a switch to new technology fixes everything (e.g. replacing furrow irrigation with a sprinkler or drip system.) Perhaps irrigation has become too familiar because it is an 'encompassing environment' for farmers and engineers; rather like the urban landscape all around us, we learn to accept and accommodate its foibles and eccentricities. In this way, it becomes difficult to discern alternatives except through comparative experiences.

On the contrary, irrigation is highly complex – comprising nested (and competing) network systems that have individual command areas that range from a fraction of a hectare to a million hectares or more (see figure 1.) Recognising irrigation means coming at it simultaneously from both a systems, water, technological, societal and policy points of view. Irrigation poses significant policy dilemmas when society seeks to apportion limited amounts of a varying water supply using gravity to many thousands of farmers and small plots – mindful of quantity, quality, timing and the need to minimise waste – in the face of changes in supply, land, soil, ownership, climate, weather, culture, economics and claims and counter-claims for water to be used in other sectors such as for urban supply or for the environment.

Figure 1: Competition for water in an irrigated river basin



As irrigation systems grow, either individually or coalescing at the basin scale, their complexity grows geometrically. In other words, evapotranspiration solves local water needs but leads to shortages many kilometres away. Such is the diversity of circumstances that policies for improving irrigation efficiency and productivity need to be continuously adjusted according to the specific mix of stakeholders, characteristics and trajectories of the systems and their contexts.

This complexity is behind scholars' beliefs that irrigation incubated the organisational strengths of ancient civilisations in Egypt, Mesopotamia and the Indus. And it was 2010 Nobel Laureate Elinor Ostrom's research on irrigation that contributed to our ideas on collective co-management of 'the commons[4].' Yet, despite irrigation being so central to society, there are surprisingly practically no bespoke postgraduate degrees or training courses in the world. Furthermore, its study has so thoroughly contracted that only a handful of research and policy

4 Ostrom, E. 1990. Governing the Commons. The Evolution of Institutions for Collective Action. Cambridge University Press.

programmes amount to current global effort. No single research council in Britain 'owns' and fosters irrigation research, often for the reasons given above, choosing to see only its social or engineering dimensions.

Excessive costs

We need to find less expensive ways of supporting irrigation. Surface irrigation is costly to build from new or to rehabilitate; the track record of donors shows that US$10,000-20,000 per hectare is spent on irrigation programmes. This is excessive and would translate to a rehabilitation bill of US$35 billion if, say, half of Africa's 7-8 million hectares of irrigation were to be improved[5]. High costs are a feature of such programmes regardless of whether canal, drip or farmer micro-irrigation is the selected technology. This expense cannot be sustained in the future.

Ways forward

If we accept that irrigation is complex and challenging, it is not surprising that a comprehensive policy framework should be considered. Its aim would be cautious and careful water management nested at all levels of river catchments, giving farmers a more predictable and timely supply of water against which they may also invest in seeds and fertilisers to raise yields. Briefly, this might require:

1. A new postgraduate qualification in irrigation systems management.
2. New financial support for the scientific organisations involved in irrigation, e.g. International Water Management Institution (IWMI) and International Council for Irrigation and Drainage (ICID), at global, regional and UK levels, including investments in research programmes.
3. Support programmes that emphasise gravity/canal systems, constituting 90 per cent of all global irrigation by area.
4. Projects and programmes that promulgate ownership of systems by their users yet in close partnership with service and science providers (see next point.)

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5 Lankford, B.A. 2009. The right irrigation? Policy directions for agricultural water management in sub-Saharan Africa. Water Alternatives 2(3): 476-480.

5. The fostering of non-governmental organisations (an irrigation equivalent of WaterAid) and of commercial stewardship, offering a new emphasis on system monitoring and mentoring and the water management equivalent of 'FairTrade'.
6. Ongoing institutional reform of government irrigation bureaucracies to orient them towards service provision to water users, setting out professional expectations of government engineers.

Success will be defined by widespread performance improvements at a cost of less than US$5,000 per hectare.

Conclusion

Given the scale of the contribution of irrigation, its nature and its impact on surrounding area, society can legitimately ask whether irrigation should perform better; to produce more food with less water. Through its once historic position, Britain led the way in addressing the challenges of irrigated food security, for example providing water engineers in India. Currently, by any measure, Britain has lost nearly all capacity to offer expertise in contemporary irrigation science and management – the kind of knowledge that would aim, not to develop new lands, but to sustainably and cost-effectively rehabilitate existing systems. The fruits of this work would be considerable – enhanced water security and performance; increased food production; and opportunities to allocate water to other sectors.

Water security, climate change and farmers' livelihoods – What future for the Niger river?

Camilla Toulmin and Jamie Skinner, International Institute for Environment and Development (IIED)

The Niger river is shared between nine countries and many users depend on its water. It flows nearly 2,600 miles from its source to the sea and carries millions of cubic metres of water from one of the wettest parts of West Africa (the Fouta Djallon highlands in Guinea where two metres of rain fall each year) to the arid Sahara fringes around Timbuktu and Gao in northern Mali, before it turns south towards its delta in Nigeria. It constitutes a shared asset of great value, a navigation route, a lifeline for herders and fishermen and, increasingly, a pivotal element in regional and national development policy. This article focuses on water choices in the arc of the river that sustains livelihoods in the Sahel, where rainfall is patchy and cannot guarantee a harvest. The region is now increasingly in the security spotlight due to the activities of Al Qaeda associates, as well as drug smuggling in the empty lands fringing the Sahara desert.

Water lies at the heart of managing to survive and prosper in this arid region. People have for millennia exploited the regular annual flood that the river Niger brings to their region. As the river rises and falls, people have developed intricate ways of using the water available to satisfy their livelihoods, built around a combination of farming, trade and mobile herds of sheep, goats and cattle. But increasingly, subsistence farming and herding are not seen as a long term development option.

Mali, like many other African countries, is facing a triple squeeze around food prices, energy costs, and climate change. The market price of rice rose 25 per

cent in early 2009, on top of increases in 2007-2008, and caused widespread hardship amongst city-dwellers for whom it constitutes the basic food. The region continues to rely on cheap rice from Asia, which out-competes domestic production. Being landlocked, countries like Mali, Burkina Faso and Niger, rely hugely on a fleet of lorries to transport their goods to coastal markets. The cost of fuel remains high, following the oil price spike of 2008 and makes it doubly difficult to compete in foreign trade. As for climate trends, there has been a marked decrease in rainfall since the early 1970s, in contrast to a period of wetter years during the 1950s and 60s. Some observers see this as a clear indication of the impact of global warming, though the Intergovernmental Panel on Climate Change (IPCC) notes that there is inconclusive evidence to date. On top of this, recent abductions of Europeans in northern Mali have done considerable damage to tourism. One hundred thousand tourists normally visit Mopti annually and, even if this riverside city is still 300km south of Timbuktu, the perception of increased risk has severely affected revenues for the sector[1].

Transforming the management of the Niger River

The Government has put in place wide-ranging plans to harness the waters of the Niger for national development. Work on the new Taoussa dam will shortly start at Bourem, which lies at the northern apex of the Niger's loop into the desert, and should provide water to generate 118 Gwh/year of electricity for the area's main cities (Timbuktu and Gao), as well as to irrigate 185,000 hectares of land at a cost of around US$200 million. To achieve this requires the enforced resettlement of 55,000 people who live in villages to be flooded by the reservoir. The Malian government is also supporting the construction of a new dam at Fomi in the Niger headwaters in Guinea that will store water during the seasonal flood and then release it during the dry season. This is critical to its plans to vastly expand irrigation in the "Office du Niger" scheme from 106,000 hectares (2006) to 199,000 hectares by 2012 and then by a further 420,000 hectares in the medium term, largely through private

1 rfi.fr/contenu/20100324-fin-saison-touristique-mali-bilan-demie-teinte

investment. Currently, it is the low flow of water in the dry season which limits the prospects for expansion in the area under sugarcane or double cropping for rice[2].

Sovereign wealth funds, and major agricultural investors have already acquired cultivation rights to large tracts of land that could benefit from investment in better water delivery. A total of 250,000 hectares has been allocated to date. Government policy recognises the need to bring in new investment and technology to raise yields and operate at a larger scale. Local farmers must either face the challenge of "going to scale" or become salaried employees in these new agro-enterprises. But there is still considerable uncertainty as to the success of these large scale schemes in practice, whether the investors will sell crops on the Malian market, thereby increasing national food security, or whether the focus will largely be for export, to Libya and elsewhere. At least one investor intends to grow biofuel crops, but it is as yet unclear whether this will be for meeting domestic or export needs.

This national policy to transform the management of the Niger River has wide-ranging implications for society and ecology. Construction of the dam at Bourem will force a shift in livelihoods from herding to farming life for those displaced. Expansion of the irrigable area in the Office du Niger will divert water away from the vast inland delta region which is currently home to half a million people, who depend on the delta to graze two million head of cattle and harvest up to 100,000 tonnes of fish. Government land allocations to large scale enterprises are made possible by the fact that the state owns the underlying rights to all land. However, these areas are not empty. Rather, this land is already being put to use for farming, grazing and wood collection, with many communities claiming long-standing customary rights of use going back hundreds of years.

As with land, water in Mali also belongs to and is managed by the state. Local people's rights to water are of secondary value in legal terms. They are thus in a

2 Analyse du potentiel d'irrigation lors de la saison sèche dans la zone de l'office du Niger; Rapport Final; dr. Rolf Schüttrumpf, Toon Bökkers, Adama Sangare, GTZ, January 2008.

weak position when government, investors or donor agencies decide to come in and "develop" water resources. In the case of the new dam at Bourem, it will be a challenge to get people to stop herding or fishing, and start farming rice – these are different skills and cultural values. There is also little evidence that irrigated agriculture can deliver the increase in yields and harvests expected, yet donors and the government still see agricultural intensification and greater capital inputs as the key to increasing crop yields and returns on available water. This strategy is fraught with risks, since it disenfranchises a large number of people who currently depend on the water. If the 55,000 people moved by the dam fail to re-establish their livelihoods within these new irrigation systems, there will be problems for years to come, as has been the case with other large dams built in the 1960s, such as Kainji in Nigeria and Akossombo in Ghana. A badly handled investment, in an area already beset with security issues, will generate further instability and growth of urban slums.

Less an issue of water availability, more a question of investment choices

The water crisis in this region is therefore less one of availability and more one of investment choices, specifically concerning in whose interests the water is to be managed. How can the government make wise choices that balance the benefits to be gained for its population as a whole? Major inward investment flows might seem to offer a solution to all three of the major 'squeezes' facing the country – food security, energy generation and climate change. Yet a closer look provides more doubt. If global warming brings less rainfall and lower river flows, how will such scarcity be managed? Whose needs will prevail when water is scarce – the agro-investors or fishermen, rice farmers and herders? How much water must be held back for hydro-electric power? What claims can downstream states exert on limited water supplies? After many years of limited activity, the inter-state agency responsible for managing the river Niger is re-establishing its role in aiding negotiation between neighbouring states.

As its stands, the small-scale rice farmer looks likely to be at the bottom of the list in terms of accessing a secure water supply, with the impacts of the Fomi dam predicted to reduce the area flooded in the inner Niger delta by anything from

11 per cent in an average year, to more than 20 per cent in a year of low rainfall. In 1985, when the Sélingué dam was built on the Niger, it was estimated that the dam would reduce water levels by 45cm in a low rainfall year. This has had a major impact on productivity over the 15,000 km^2 of floodplain. The direct consequence of building the Fomi dam and expanding the irrigated area in the Office du Niger will be to increase the risks to downstream users in the Inner Niger delta, particularly in years of low rainfall.

How can a drought-prone country like Mali make the most of its water assets for a range of functions – irrigated farming, generating power, grazing and water for livestock and fishing – and maintain the resilience of millions of people to climate change along its length? Will the involvement of large investors strengthen production of key commodities? And if so, must this be at the expense of marginalising local people? Some of the answers will be found in the ability of local people to adapt and seize new opportunities, if the government can open up debate on the choices ahead. Currently, many of the land deals are being done behind closed doors, despite their enormous implications for the country's future. Without wider scrutiny and input, there are risks that land contracts will be written in ways which disproportionately benefit the inward investor. The government may also find its room for manoeuvre tightly circumscribed, given contracts that grant powerful external actors a legal right to command scarce water resources, thereby generating the potential for further scarcity and insecurity.

SECTION TWO
A RIVER RUNS THROUGH IT: THE ECONOMIC IMPERATIVE FOR MANAGING WATER WISELY

Trading out of poverty and water scarcity: Threat or opportunity for the rural and urban poor?

Professor J. A. (Tony) Allan, King's College London and School of Oriental and African Studies (SOAS), London

The big challenges

The purpose of this analysis will be to answer two questions. First, can international trade in food commodities help poor people, both rural and urban, to be food and water secure? Second, can the livelihoods of poor farmers be the first stage of a supply chain that gets their output on to the international market?

Three things need to be understood before we answer these questions.

1. Farmers and water management

First, most poor people in the world are involved in farming. Farmers are the main managers of water world-wide. They manage 80 per cent of the water used by society. They manage all the green water – the effective rainfall in the soil profile that produces 70 per cent of all crop and livestock production. The other 30 per cent is produced with freshwater – blue water or irrigation water – provided by engineers. Engineers deliver blue water from surface and groundwater sources, i.e. from rivers, lakes and aquifers.

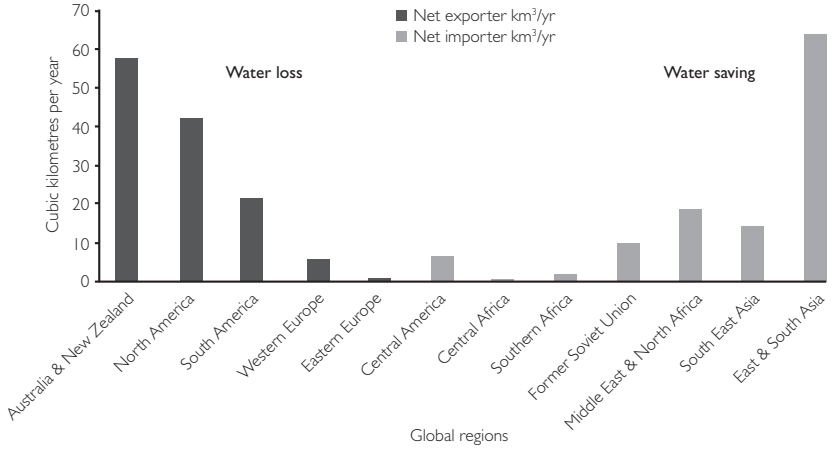
With these blue and green waters, farmers combine over 20 other inputs, such as fertilisers and pesticides. The skill they have deployed and continue to deploy determines the level of returns to water. On these skills rests global water security as well as the livelihoods of individual families. The productivity of water can be increased ten times if farmers have access to high quality inputs, high quality transportation and storage and to highly effective markets in orderly financial and social environments.

Chinese and Indian farmers – most of them poor – have increased water productivity three to four-fold since 1960. Farmers need to be incentivised to achieve higher returns to water so they can cope with the shocks of climate and the market. Poor farmers in sub-Saharan Africa manage extremely challenging water and soil endowments without access to high quality inputs and effective economic and political infrastructures. They achieve very low returns to water and as a consequence endure long term poverty.

2. Water security and trade

Second, a community or economy can be water secure if it can trade. It requires 1000 tonnes (cubic metres) of water to produce a tonne of wheat. If an economy imports a tonne of wheat it does not have to endure the economic and political stress of mobilising non-existent local water. Rich economies can easily engage in virtual water 'trade'. Poor economies cannot. Although they have been able to, as some food staples such as wheat have, during recent decades, been available on the world market at half production costs as a consequence of EU and US subsidies. Figure 1 below shows that it is the industrialised economies that export virtual water. Figures 2 and 3 below show that poor economies trade very little, including in food. They neither import much, nor do they export much.

Figure 1: International virtual water 'trade' showing the predominant exporting regions and the major 'importing' regions

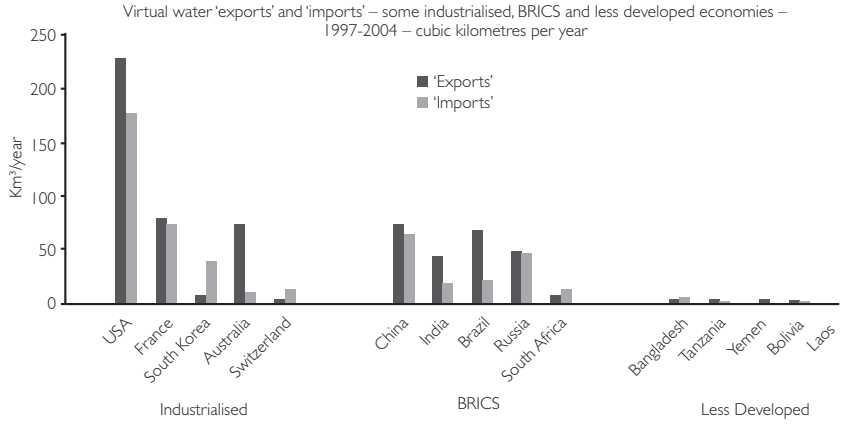


Virtual water is of vital importance to the water security of an economy and to regional stability. The Middle Eastern and North African economies only have 60 per cent of the water resources for total food and water security. Despite the rapidly worsening situation, there has been no sign of armed conflict over water. Nor will there be armed conflict over water when these economies are only 30 per cent food and water self-sufficient at mid-century. Virtual water trade is wonderfully economically invisible and politically silent!

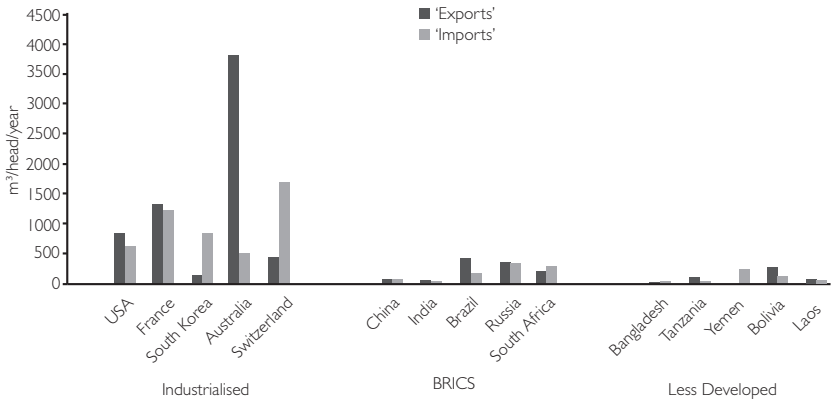
3. The global poor and international trade

Third, poor people are not much engaged in international trade, whether as part of an export supply chain, or as consumers of imported food commodities. Figures 2 and 3 show the degree to which both the industrialised BRICS (Brazil, Russia, India, China and South Africa) and developing economies engage in international 'trade' in virtual water. About 15 per cent of crop and livestock production enters international trade. This small proportion is sufficient to keep 200 or so economies in the world water secure.

Figures 2 & 3: The volumes of virtual water 'imports; and 'exports' of some industrialised, BRICS and developing economies and the levels of 'imports' and 'exports' per head



Virtual water 'exports' and 'imports' in cubic metres per head – some industrialised, BRICS and less developed economies – 1997-2001 per year



International trade in food commodities does, in general, very effectively address the water scarcity of the four in five economies worldwide that are net food and virtual water 'importers'. All the net food importers in the industrialised world – there are about 35 – achieve water security through commodity trade. Two of the five BRICS economies – India and Brazil – are fortunately net food and virtual water 'exporters'. Russia should be. China is a minor net food importer and its virtual water 'exports' in industrialised goods make it a net virtual water exporter.

Can international food commodity trade help poor people?

It is the economies of sub-Saharan Africa – there are about 45 sub-Saharan economies out of the about 160 developing economies worldwide – that have found engagement with global food commodity trade most difficult. Neither agricultural commodity importing nor agricultural commodity exports have brought effective economic solutions because the terms of trade in both directions have been and remain very disadvantageous.

Food commodity trade does bring a version of food and water security. Food assistance and half-cost staple food commodities on the world market address the periodic crises associated with periods of drought. No government of a poor

sub-Saharan economy has any alternative but to receive food aid and import subsidised food from the world market. But in doing this, local farmers are prevented decade after decade from enjoying higher prices associated with the tightening of the market for their products at times of drought. Poor farmers in Ethiopia and elsewhere in East Africa have been knocked back by these adverse market circumstances.

International food commodity and virtual water trade and aid do help poor people in poor sub-Saharan African economies and they are especially important for the urban poor. At this point in the economic history of Africa, weak governments in poor economies have no alternative. But the consequences for the social and economic development of these poor economies are very negative. Low global food commodity prices are very attractive but they significantly impair the pace at which the livelihoods of very large rural populations can be secured.

Can the livelihoods of poor farmers be the first stage in international supply chains?

The second question to be addressed is can the livelihoods of poor farmers and their outputs be the first stage of a supply chain that gets their produce on to the international market? In addition, can outputs from poor developing economies be marketed internationally in ways that leave them with significant benefits? And can such international trade be the foundation for secure and long term rural livelihoods?

History is not very encouraging. Food and other agricultural commodity production has a long and tragic history in tropical countries. It is associated with imperial exploitation of natural resources and a worse record in the enslavement of human labour. The latter has been addressed and the plight of the environment is on the agenda. But the terms of trade remain firmly in favour of rich, ex-imperial interests and the transnational corporations that embody those interests. The principles of fair trade are much higher on the global agenda than they were half a century ago, but the World Trade

Organisation (WTO) remains mainly an impediment to rather than a champion of the interests of poor farmers in weak economies.

The surge in interest in inward investment in land and water resources brought on by the food commodity price spikes of 2008 is more a threat to the rural poor than a potential benefit. This phase of inward investment is really a water grab. Land is not in short supply if viewed globally. It is land with either enough soil water – that is effective rainfall – or access to irrigation water that is in short supply.

The crop and livestock yields in many poor African economies are very low. Grain yields of less than one tonne per hectare on rainfed land are usual. Poor undercapitalised African farmers without adequate inputs, roads, markets and an orderly political economy have failed to increase returns to water. Farmers in industrialised and BRICS economies have increased the productivity of water between three and ten times in the past half century.

In an ideal world, the material and governance infrastructures in these poor economies would be improved. The farmers would then be able to increase their crop and livestock productivity to meet national needs, as well as demands from global markets. The risk of engaging with the water and land grabbing international interests will be tempting. This is especially the case because supply chain infrastructures will be integral to inward investment in water and land. The downside for poor farmers is that they will once again be at a disadvantage. The global terms of trade will still be against them and they will still have no voice in the supply chain processes.

Conclusion

Effective food production and effective and fair international food trade are all essential for developing farming livelihoods in poor economies where populations are expanding rapidly. Such advances are also essential because populations will rise less quickly if these poor economies diversify and strengthen.

The key ideas are that the livelihoods of poor farmers are very important. Poor farmers handle scarce water resources and scarce water everywhere must be

used as effectively as possible. Farmers must be enabled to cope with uncertainties in rainfall and poor soil endowments. Just as important is the institutional environment in which farmers operate. Improved returns to water can be achieved by making markets safer and more efficient, by improved transportation, improved storage, improved communications and institutions that help farmers mitigate the uncertainties of the market and the weather. These were the measures that enabled improved returns to water in Europe since the beginning of industrialisation and they would achieve improved returns to water in Africa. Sub-Saharan Africa needs to double or treble its water productivity, especially in rainfed crop production.

Farmers also need to be protected from the negative impacts of unfair trade. The region where farmers need to increase returns to water most – Africa – are prevented by the unfair global trading system. World prices for commodities such as wheat are still determined by subsidies in Europe and the United States. Poor farmers in Africa are repeatedly knocked back by low-priced food imports. This is especially destructive at times of drought when local prices could go up. These farmers can never gain surpluses with which to invest. Rather, their capital base has progressively worsened. Yields decline rather than increase and nothing short of a three fold increase will be necessary to meet local demands, never mind those of global markets.

Risky business: Why multinationals are worrying about the global water crisis

David Nussbaum, WWF-UK

At the water's edge

Last year Chinese authorities approved a billion dollar programme to support the restoration of wetlands in Hubei province. Nature conservationists cheered. Many of the province's fragile freshwater ecosystems have been destroyed over the last century as a rising population, breathtakingly rapid urban development, the drive for increased agricultural production and massive industrial growth have taken their toll.

But the decision to spend so much to repair some of this damage wasn't entirely motivated by concerns for wildlife. Recent conservation efforts along the central Yangtze have convinced decision-makers that better care of ecosystems can help to remediate pollution and support the provision of potable drinking water. It might contribute to flood management too[1].

China is growing worried about its water. Officials and politicians recognise that overuse and pollution of rivers and aquifers may soon act as a brake on economic development. Competition over water is already a source of conflict between urban and rural communities[2]. The Ministry of Water Resources in Beijing is currently

1 An example is the WWF project, supported by HSBC, on part of Lake Hong in Hubei Province. Planting of aquatic vegetation, controls on intensive fishing and the restoration of seasonal flows between the Yangtze River and the lake resulted not only in gains for biodiversity but in a rapid increase in water quality such that local communities were able to use the lake as a drinking water source for the first time in many years. Subsequently, local authorities committed to restoring the whole of the 412 km^2 lake.

2 See for instance *As economy booms, China faces major water shortage*, Washington Post, Tuesday March 16, 2010; also Economy, Elizabeth C. 2007. The Great Leap Backward. Foreign Affairs

developing new long term plans for managing the country's major rivers. Sustainable management of China's sources of freshwater is likely to be at the heart of these plans.

China is not alone in facing up to the links between the use and abuse of water and the demands of a growing economy. Recent studies from JP Morgan[3] and McKinsey & Company[4] (leading the 2030 Water Resources Group), highlight the potential impact of future water shortages on other emerging economies such as India and South Africa. Many of the world's poorest countries, such as Tanzania and Bangladesh, are even more dependent on water as a foundation for the mainly agricultural livelihoods of their people. Developed countries aren't immune either; Australia is already grappling with the twin spectres of water scarcity and climate change and parts of the USA and Spain are in a similar situation.

All of which has encouraged organisations such as the World Economic Forum and the Organisation for Economic Cooperation and Development (OECD) to take almost as much of an interest in water issues as environmental groups such as WWF. The world, it seems, has woken up to the fact that we all live at the water's edge.

Shared risk, collective solutions

Water scarcity has particular relevance to industrial sectors such as agriculture and food, beverages, textiles, mining, energy and, of course, water supply. These are the businesses that have the greatest dependency on water either because it is a core ingredient in their products, or because of irrigation, processing, cooling or cleaning functions in their value chains. Although many are headquartered in parts of the world where rainfall is relatively plentiful, the multinational giants in these sectors invariably have subsidiaries, joint ventures or suppliers which are directly affected by problematic water supplies. So it's no surprise that blue-chip names such as SABMiller, Coca-Cola and Nestlé are among the main movers and shakers in the global debates about the precious liquid.

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3 Levinson, M. et al. 2008. *Watching Water: a guide to evaluating corporate risks in a thirsty world*. JP Morgan

4 2030 Water Resources Group. 2009. *Charting our water future: economic frameworks to inform decision-making*, McKinsey & Company

The bosses of these companies are primarily concerned about risk to their business from water shortages or from polluted supplies. This risk can play out in different ways[5]. Physical scarcity of water can simply force factories or farms to shut down. Regulatory risk occurs when there is uncertainty over government restrictions on, and charges for, water use. Such uncertainty hampers business planning; worse still, rapid change in regulation can have significant implications for business costs and capacity. Finally, the perception – accurate or not – that a company is hurting local communities or the environment by polluting or over-using water implies a reputational risk to many businesses. In a world of shifting consumer ethics and investor expectations, this can damage brand value, decrease market share and weaken a company's social license to operate.

One of the distinguishing features of water compared to other natural resources is that there is normally no available alternative. Hypothetically, if a CEO wants to reduce carbon emissions, his or her factory can substitute electricity generated from, say, a hydropower plant for that obtained from a coal-fired power station. But the CEO of the coal-fired power station can't use anything other than water for cooling and the manager of the hydropower plant has an obvious need for the river to keep flowing. Likewise, farmers can use only water for irrigation. A brewery can use nothing but water as the main constituent in its beer. More efficient use can help to reduce risk but, ultimately, all these businesses rely on a steady supply of H_2O.

Combine this 'universal non-substitutability' with the fact that, at any time in any given place, there's only so much water to go around and the result is shared risk. The coal-fired power station is as much at risk from low river flows or a depleted aquifer as other water users, including the hydropower plant, the farm and the brewery if they happen to be located in the same river basin. The onset of climate change, and uncertainty about future rainfall patterns and river flows, greatly exacerbates this risk in many places.

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5 For discussion on the typology of water risks see Levinson, M. et al ibid.; Orr, S. et al. 2008. *Understanding Water Risks,* WWF-UK; and Pegram, G. 2010. *Global water scarcity: risks and challenges for business.* Lloyd's and WWF-UK.

The notion of shared risk is increasingly seen as a critical element underpinning responses to the global water crisis. It suggests that businesses, motivated by enlightened self-interest, can both contribute to and benefit from collective efforts to better manage water sources. Put simply, the business case goes like this:

> *My business uses water and so has an impact on other water users and the environment. If I use too much water, other users complain and I lose my social license to operate. If they use too much water, my business suffers from shortages. If we all use too much water, the government will impose stricter regulations. If the environment and local communities suffer from our collective over-use of water, my business may get the blame. So the best way I can manage my risk is to work with other users, governments and NGOs to manage rivers and aquifers better.*

A new water stewardship ethic

To help develop this approach, WWF has joined with other NGOs to establish the *Alliance for Water Stewardship*, loosely modelled on successful standard-setting and certification approaches for forest products, fish and other commodities. WWF has also formed the Water Futures partnership with SABMiller (the world's second biggest brewer) and GTZ (part of the German international development ministry.) This joint effort seeks to trial the 'shared risk/collective solution' concept in four countries where water scarcity is already a reality.

WWF is by no means the only organisation striving towards this end. Initiatives such as the UN Global Compact's *CEO Water Mandate* are heading in a similar direction. Indeed, there are growing signs of a shift in the old water management paradigm that emphasised the provision of water supply to meet demand regardless of sustainability concerns.

To understand the emerging water stewardship ethic, it is first crucial to appreciate that the availability and quality of water varies from place to place and, sometimes, from season to season. This variability dictates that companies should look beyond the headline volume of water used and consider the impacts of that use on natural

and economic systems. For instance, using 100 litres of water in a wet country such as Scotland may have less of an impact than using just 10 litres in arid Pakistan or Australia. Combined with the distinctiveness of cultures and societies, this means that there can be no global, cookie-cutter response to water scarcity (this, incidentally, is one reason why siren calls for a single global price for water are misconceived.)

Nevertheless, it is possible to distinguish four basic elements of the new approach to managing water:

- The first element, described above, is **a greater contribution of water-dependent companies to the management of water resources as a means of managing business risk**. Even pioneer companies are only at the start of this journey and there remain questions as to how businesses can bring influence and resources to bear in a way which is transparent and inclusive. But already we can see evidence of progress. The fact that investors and financial institutions are beginning to expect companies to do more to manage water risks will be an important influence[6].
- Secondly, **governments must ensure that there is an appropriate regulatory framework in place for allocating water to different users.** As well as ensuring that basic human needs are met and that there is an equitable approach to allocating water for productive economic and other uses, laws and policies are increasingly prioritising the maintenance of river flows and aquifers, not least because of the need to ensure water supply to downstream users.
- The third basic part of the emerging stewardship ethic is the **improvement in industrial and farming practices to produce better output from every litre of water used.** WWF projects in India and Pakistan, supported by IKEA, Marks & Spencer and the European Commission, have demonstrated that it is possible to improve farm incomes while reducing water use and inputs of pesticides and fertilisers during cotton production. It has also shown that the

6 Banks such as Standard Chartered and HSBC have issued policies and positions statements on water issues in recent years. The Carbon Disclosure Project has also started a water project which seeks to clarify for investors the degree to which companies are taking account of water risks in business decisions.

technology behind more efficient water use is often straightforward. The barriers to wider uptake of such practices are largely related to awareness and farmers' loyalties to familiar ways of doing things.

- Finally, and most importantly, **there is an urgent need to build strong, politically-independent water management institutions** in most parts of the world. Experience has shown that unless these organisations have the manpower, technical capability and mandate to enforce fair and sustainable water allocations, reductions in shared risk derived from more efficient practices on individual farms or in factories are lost simply because someone else uses the water that has been saved.

Too many rivers across the world still run dry leaving people and nature without water. Many businesses, as well as some governments, have yet to realise the risk posed by water scarcity. There is a long way to go before a more sustainable, stewardship-based paradigm takes hold with the private and public sector working in concert with civil society to address shared risks. This emerging framework, however, provides grounds for some cautious optimism.

The economics of water management

Dr Martin Stuchtey, McKinsey & Company

In a world where demand for water is on the road to outstripping supply, many countries and regions are struggling to find the water they need to supply their populations, irrigate their crops, and run their economies. A larger global population and growing economies are placing bigger demands on already-depleted water supplies. Agricultural run-off and other forms of pollution are exacerbating the scarcity of water that is clean enough for human and industrial use in some regions and climate change may worsen this problem.

Still, despite the risk that water scarcity poses to social wellbeing and economic growth, in most countries there has been alarmingly little progress in developing an effective response to the mounting challenge of managing freshwater sustainably. Elements of a solution exist – from examples of progress on the policy front, to individual pilots of successful water stewardship at the basin, national and transboundary level – but momentum has not built as fast as was hoped.

Meeting all competing demands for water is in fact *possible at reasonable cost.* But this outcome will not emerge naturally – it will require a concerted effort by all stakeholders, the willingness to adopt a total resource view where water is seen as a key, cross-sectoral input for development and growth, a mix of technical approaches and the courage to undertake and fund water sector reforms.

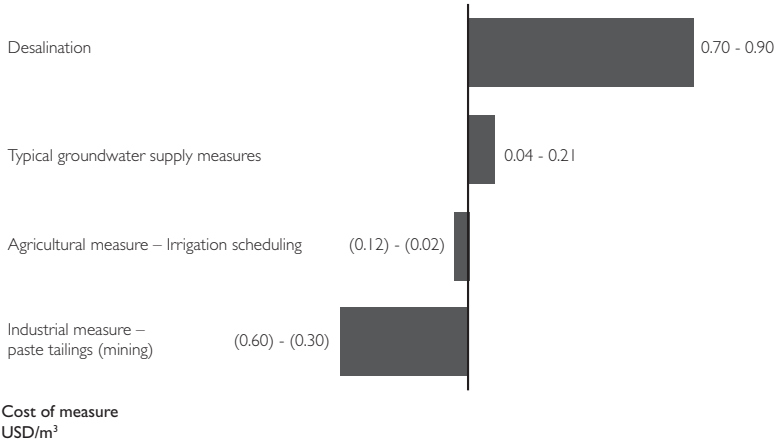
There is no question that such efforts are national and local in nature. At the same time, it is also clear that there are international experiences that can and should have a role in supporting pathways to effective national water management.

The challenge ahead

Constraints on a valuable resource should draw new investment and prompt policies to increase productivity of demand and augment supply. However, for water, arguably one of the most constrained and valuable resources we have, this does not seem to be happening. Calls for action multiply and yet an abundance of evidence shows that the situation is getting worse. Economic data is insufficient, management is often opaque and stakeholders are insufficiently aligned.

Water resources frequently face inefficient allocation and poor investment patterns because investors lack a consistent basis for economically rational decision-making. Historically, for example, the focus for most countries in addressing the water challenge has been to consider additional supply, in many cases through energy-intensive measures such as desalination. This has caused an ever steepening cost of provision and environmental damage, economic efficiency measures, such as irrigation scheduling in agriculture (see figure 1) have been completely overlooked.

Figure 1: Representative demand- and supply-side measures



Source: 2030 Water Resources Group

As a consequence, many countries face a growing gap between the amount of water they can reliably supply to their economies and the amount they need. Assuming continued economic and population growth, by 2030 water supplies will satisfy only 60 per cent of global demand and less than 50 per cent in many developing regions where water supply is already under stress, including China, India and South Africa. Closing this gap by increasing supply – through desalination, the drilling of deep wells, or transporting surface water – will be extremely difficult and expensive.

Solutions are possible

A different approach to water resource management is needed, and solutions to these challenges are in principle possible and need not be prohibitively expensive. Cost effective solutions to close the gap do exist, even if we focus only on technical solutions that do not require changes in the underlying economic activities of a country. When scaled to total global water demand, an annual incremental capital requirement of approximately US$50-60 billion would be necessary by 2030 to close the water resource availability gap, if done in the least costly way available, which takes into account both demand-side efficiency gains and incremental supply. This is almost 75 per cent less than would be required for a supply-only solution and less than 0.1 per cent of forecast global GDP.

Agricultural productivity is a fundamental part of the solution. In India, for example, the least-cost set of measures to close the water resources gap in 2030 — those on the left-hand side of the cost curve (see figure 2) — is dominated by water productivity measures in agriculture that increase 'crop per drop' through a mix of improved efficiency of water application, such as drip and sprinkler irrigation, and net water gains through crop yield enhancement, for example from optimised fertilizer use or the application of crop stress management. Such agricultural measures can collectively close 80 per cent of the gap in India. In combination with lower-cost supply measures, delivered mostly through the rehabilitation of existing irrigation districts and the 'last-mile' completion of earlier projects such as canals, the total annual cost to close the gap is approximately US$6 billion per annum, again just more than 0.1 per cent of India's projected 2030 GDP.

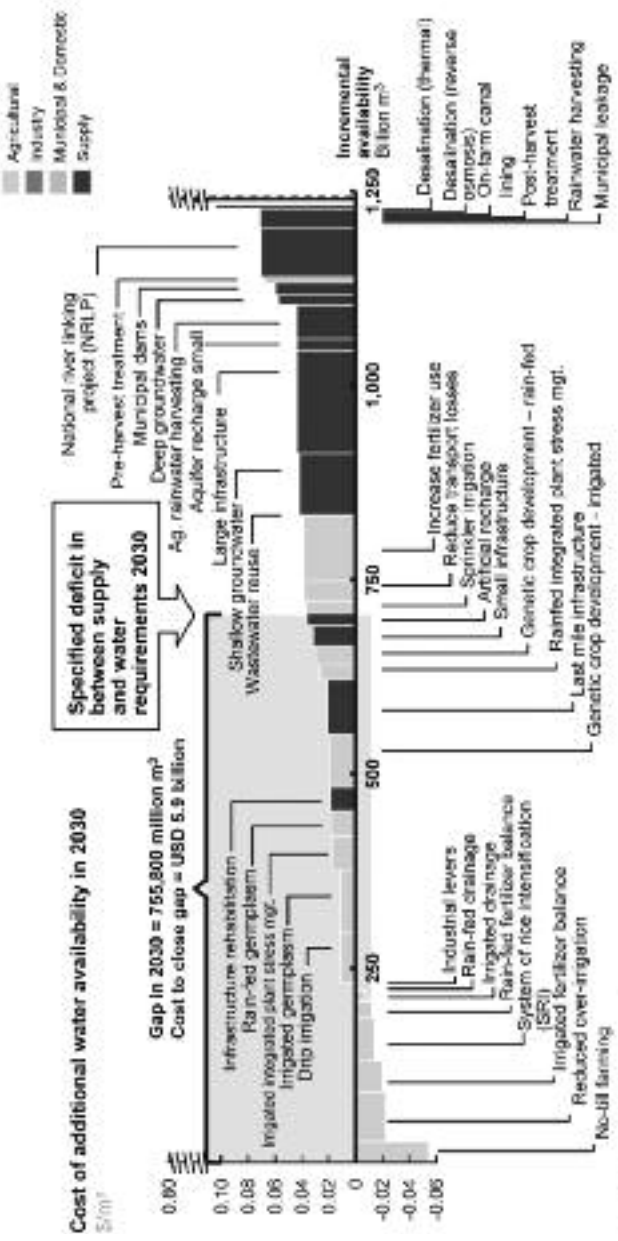


Figure 2: India – water availability cost curve

By contrast in China, increased efficiency in industry and municipal systems is critical to close the gap in a cost-effective way. The rapid growth of around three per cent per annum in China's industrial and urban water demand points towards aggressive, water-conscious, 'new build' programmes and water-saving regulatory reforms. Agricultural productivity, on the other hand, plays a much more limited role.

China's least-cost set of measures highlights an important benefit: many of the industrial water efficiency measures across industries have a significant potential for savings in energy and other operational expenditures, translating into overall productivity gains. As a result, the cost of many measures is negative, implying net cost savings over the course of their lifetime. On aggregate, this suggests a net annual savings potential of approximately US$22 billion from implementing the least-cost set of measures to close the gap in China.

However, such outcomes will not emerge naturally from existing market dynamics, which today are often still characterised by a lack of incentives to manage water resources sustainably, such as insufficiently defined water rights and water tariffs that do not recover costs. Instead, efficient, sustainable outcomes require a concerted effort by all stakeholders and the courage to undertake and fund water sector reforms that employ a mix of appropriate technical approaches across sectors. Stakeholders must be willing to adopt a total resource view where water is seen as a vital, cross-sectoral input for development and growth.

The need for change

Business-as-usual in the water sector is no longer an option for most countries. Many recent initiatives of the private and not-for-profit sectors have made a vital contribution to raising the awareness of this challenge globally. As a consequence, the beginnings of change are under way and good management practices that set the right incentives are slowly emerging. So how can these examples help scale up the level of ambition and close the projected water supply-demand gaps in an efficient and sustainable way?

An integrated agenda of water sector transformation is needed to capture a sustainable solution:

- Change strategies with a vision which is underpinned by sound analysis, including an economic assessment. National decision-makers and stakeholders must understand the range of options and the costs and benefits of each before setting out a strategy for optimising the management of water.
- Given the nature of water, running across all sectors, averting water shortage is most of all a challenge of implementation. Creative and innovative practices, especially in the private sector, can help to deliver successful outcomes
- Given the social and political sensitivities around the water challenge and the complexity of the sector in most countries, any transformation effort has to have national and local government in the driver's seat with responsibility for shaping the transformation agenda.
- Pervasive change requires broad stakeholder mobilisation. In transforming the management of water resources, the public, private, and not-for-profit sector all have an important role to play. Aligning all critical stakeholders is difficult but doable. It does however, require credible leadership and radiation all across sectors.

There is no question that such efforts are both national and local in nature. At the same time, a platform for the exchange of best practice, peer reviews and access to global knowledge and resources is critical. Such an exchange is not limited to traditional channels of foreign policy and international aid. New coalitions of local and international businesses, non-governmental organisations, research institutions and international organisations can play a critical role in catalysing and accelerating change.

The Water Resources Group is a good example of such international cooperation. Initially established in 2008 by a consortium of public sector and business partners, its aim was to contribute fresh thinking to the issue of water resource scarcity. At the 2010 World Economic Forum in Davos, a number of WEF members committed to sharing best practice and support to countries that are willing to embark on a process of change.

The case for pursuing a revolution in water resources management has never been stronger. The aim now must be to create successful case studies that act as a source of inspiration and provide models to help accelerate change globally, to avoid the looming water resources gap. The challenges ahead are considerable for many countries, but none are insurmountable.

SECTION THREE
NOR A DROP TO DRINK: WATER AND HABITATS FOR PEOPLE AND NATURE

Getting drinking water and sanitation on to the global policy agenda

Fiona Harvey, The Financial Times

Improving the poverty reduction impact of aid

Diverting aid money toward the provision of clean and safe drinking water in the poorest countries of the world is one of the fastest and most efficient ways of improving those countries' development potential. Every US$1 spent on water and sanitation yields a return of US$8-10 in economic development, according to a study entitled *Safe Water as the Key to Global Health*, carried out in 2008 by the United Nations University Institute for Water, Environment and Health.

Access to clean water and decent sanitation is also a prerequisite for the efficient provision of other services. Aid money spent on hospitals is simply wasted if treated patients go home to slums or villages where they catch disease from poor hygiene, and cash for schools is to little avail if the schoolchildren have to stay away through illness. More than 5,000 children a day die from easily preventable water- or sewage-borne diseases.

As well as the human loss, there is a severe economic loss. Sickness prevents people from working and earning money. The waste of time – and sometimes the physical danger – involved in fetching water from far away is often considerable. High prices are often paid to street water sellers for poor quality water. Girls in developing countries are often forbidden to continue their education after puberty because there are no decent toilets at school to give them privacy.

Making water and sanitation matter

The United Nations University said in the same 2008 study cited above that, 'development aid would be much better spent if we tackled the water and sanitation issue first'. And yet water and sanitation are rarely mentioned in discussions of economic development

and foreign policy, and are increasingly neglected in the provision of overseas aid. A 2008 study – entitled *Sanitation and Water: Why we need a global framework for action* – carried out by Tearfund and WaterAid in 2008 found that donor countries had actually reduced their spending on water and sanitation as a proportion of their overall aid budgets.

Even in the context of the Millennium Development Goals (MDGs), water and sanitation are assigned a low priority: water is tacked on as a seeming afterthought to MDG 7, though it contains a tough target of halving the proportion of people without access to safe drinking water by 2015, with a weaker aspiration for a "significant improvement" in the lives of 100 million slum dwellers.

Among individual and corporate donors, water does not receive the attention it warrants. For its 2008 Christmas charity appeal, the Financial Times chose WaterAid, one of the best-known charities working in this sector. Accompanying the appeal was a series of hard-hitting articles from around the developing world, which made it clear how fundamental water is to all forms of development, how easy it is to transform lives and economies by simple measures such as teaching people how to build pumps and make soap.

That year, the newspaper's appeal raised £167,389. Not a bad figure, and a substantial fillip to WaterAid's budgets, but it was a far cry from the £2.2m raised by a similar appeal in the previous two years for Camfed, a girls' education charity, and the US$4.3m raised in 2009 for another education charity, Room to Read, which provides libraries and literacy skills.

Granted, the 2008 appeal took place in the midst of the financial crisis, when the worlds of banking and industry were still reeling from the worst financial shock since the second world war. By this year, the world's stock markets and bankers' bonuses had bounced back. Even so, it is hard not to conclude that there was more to the stark contrast between the responses. Water is not regarded in the same light as education, health and even other infrastructure issues such as transport.

When the arguments for prioritising water and sanitation provision are so cogent and so convincing, why are politicians, philanthropists and the public so unwilling to

accord water its fair share of resources? In part, it is simply a failure to appreciate the significance of water and sanitation provision as a building block that enables other forms of economic development. Another factor, particularly in the mind of the public, is the prevalence of stories – we've all heard them – about well-meaning charities parachuting into an area, sinking a well or building a pump, that within a few years has silted up or broken, putting the local people back to square one.

Making it simple

This problem, at least, is being solved. Mark Charmer, an advisor to Akvo, which provides access to best practices in water and sanitation provision, says organisations have realised that putting in fancy equipment is no good. "The thing is to make it simple, so that it can be fixed with materials that people have access to, like rope," he says. "It doesn't matter if [the pump, toilet, or other infrastructure] breaks all the time, as long as it can be easily repaired."

Another more serious problem is the inescapable fact that talking about sanitation means confronting something very unpleasant and a universal taboo. That's right – toilets mean poo, excrement – in essence, 'shit matters!'

One water NGO tells privately of a donor organisation – a large, famous and rather trendy organisation teeming with celebrities – that said it was very interested in working on water, but shied away when the topic veered on to waste water. "We don't do sanitation," the NGO was sniffily told. Toilets simply did not fit in with that carefully cultivated sexy image.

Solving this will require touching the subject with a little glamour. A few celebrities talking frankly about the sanitation problem would go a long way to helping break this taboo and allowing water organisations to talk about it.

Akvo is trying to bring a little much-needed humour and glitz to the debate, with posters that mimic the designs and conventions of Bollywood musicals. In one, a glamorous Indian man and woman gaze into each other's eyes, with a wind-powered water pump in the background. A caption reads: "Anyone can make such a pump, so why can't we?" (see figure 1.) Another is designed as "WATER! The smash hit musical from Africa!" (see figure 2.)

Figure 1

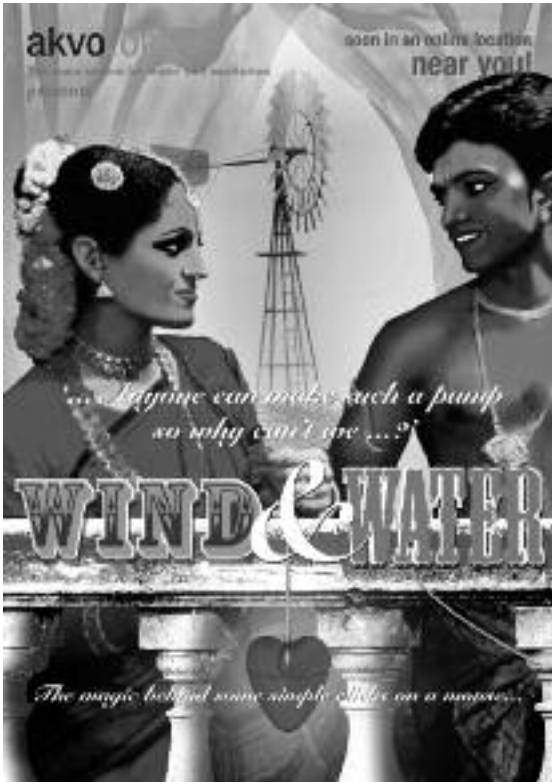


Figure 2

Non-governmental organisations need to speak with one voice on this issue. Trusted organisations, such as Oxfam and Save the Children, have already talked about water, but could make more of the need for sanitation.

Water specialists also need to explain once again to donors how a failure to ensure water and sanitation are available when development aid is allocated means that money spent on issues such as health and education and providing economic opportunites is wasted, and they need to quantify how much is wasted.

Political will

But there is one final obstacle to moving water and sanitation up the international development agenda, and it is harder to overcome. This problem is political.

For decades, water has been a political minefield across the developing world, as well as among aid agencies and in academic circles. The central argument has been over whether water should be supplied through the public sector or by private companies.

Paul van Koppen, an independent consultant who acts as an advisor to the Dutch government on water issues, says: "People see water as a basic human need and public good. That makes it very complicated."

It can be argued that water provision – like so many environmental problems, including climate change – represents a market failure. Private companies have found it uneconomic to provide water to the poor when they can provide water at much higher margins to the rich – who also soak up most of the developing world's water subsidies.

If water is to be a human right, some argue, it can only be provided by the public sector.

However, private water companies contest this view. AquaFed, an international association for the sector, says: "Private water operators are making the right to

access water and sanitation a tangible reality for people. That is their job all over the globe. They have improved water access and sanitation to tens of millions of families in the developing world."

In March 2008, the Human Rights Council of the United Nations set up an expert group to explore whether access to safe water and sanitation should be a basic right, with three years in which to report.

To compound the political problem, corruption is also a serious menace in the water sector, according to Transparency International (TI). In a 2008 report, the NGO found that corruption was a major cause of water shortages in developing countries. Corruption added 25 per cent to the cost of irrigation contracts in India, and in China bribery led directly to the pollution of aquifers in many cities and to the dumping of pollutants in vast numbers of urban rivers. TI called for countries to strengthen the independent regulation of water and to ensure fair competition for water contracts.

The political debate over private versus public provision has gone on for decades, with no end in sight. It is not surprising that donors shy away from involvement in it. Although health and education are also supplied by a mixture of public, private and philanthropic sources, those two sectors have not been subjected to the same ideological battles that have scarred the water sector. For donors, devoting money to health and education is far less controversial than meddling with water.

It is time to acknowledge that there is no perfect solution to the question of public or private water provision, that both must play a role in different parts of the world, and to take the heat out of this argument. When donors can be reassured that they will not find themselves mired in a political minefield, they will be more willing to move water to where it should be: at the heart of international development policy.

Women's rights and the future of water

Belinda Calaguas, ActionAid

In less than 20 years, almost half the world's population will be living in water scarce areas. Scaremongering analysts often tend to depict this crisis as a potential armageddon in which we will find ourselves in a world torn apart by competition for limited water supplies. In truth, the crisis in water is not about having too little water to satisfy human and ecosystem needs. Rather, it is about "managing water so poorly that billions of people – and the environment – suffer badly[1]."

Against this backdrop, it is perhaps not surprising then that policy-makers have begun realising what NGOs have been saying for some time: lack of global water security is one of the most pressing political challenges we face today.

While this increased awareness is very much welcome, I am deeply concerned that in the well-intentioned haste to address water insecurity and its effects, global leaders will miss an essential component to the solution – women.

The growing recognition of the impact of water scarcity on women and the important role they can play in addressing it is, rather foolishly, not being matched by an inclusion of women in local, national and international discussions on water security. Unchecked, this failure to incorporate women in decision-making will spell disaster for more than just women; the future of our water supplies will be the ultimate price.

The persistent exclusion of women from water management decisions is nonsense, not least because women continue to be the primary water managers in most communities.

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1 Cosgrove, William and Frank Rijsberman for the World Water Council, 2000. *World Water Vision: Making Water Everybody's Business*. London. Earthscan Publications, Ltd. p ix.

They bear the brunt of the responsibility for water collection for their families, are among the first impacted by lowered water tables due to climate change through their roles as the primary producers of subsistence food, and are almost wholly responsible for caring for those who fall ill from water-borne diseases in their communities. Even today, women remain the main users of water points when they are created in villages.

Because they are the primary users of water in most communities, women have expertise in water resource management in their regions that is unparalleled. Their skills and knowledge about what works stems from direct experience of having to manage the resource on a daily basis. Indeed, research has shown that increasing women's involvement in the analysis and design of water projects can lead to improved efficiency and effectiveness in the use of water resources, and more sustainable and equitable distribution of water than those that do not include women.[2]

Despite this, women are generally excluded from the institutions and processes that govern the management of water at all levels. They are simply not given the political space to share their knowledge, voice their views or influence outcomes. The World Water Council has 32 board members, of whom three are women; the International Water Quality Association has no women on its board; and the Steering Committee of the Global Water Partnership (GWP) includes only two women and 17 men[3].

The lack of a political voice significantly hampers the positive contribution women can make. As a result, there is a constant risk that solutions to the problems of water insecurity fail to improve the situation of those most affected by them.

This exclusion of women is not for the lack of women trying to speak out or make a difference. Examples of successful women-led community water management projects are not hard to find. The Wanaraniya Water Project in Sri

2 'For Her It's the Big Issue: Putting women at the centre of water supply, sanitation and hygiene', Water Supply and Sanitation Collaborative Council (WSSCC) and the Water, Engineering and Development Centre (WEDC), Geneva, by Julie Fisher, 2006, wsscc.org/pdf/publication/FOR_HER_ITs_THE_BIG_ISSUE_Evidence_Report-en.pdf

3 Aladuwaka, Seela and Momsen Janet 2010, *Sustainable development, water resources management and women's empowerment: the Wanaraniya Water Project in Sri Lanka* p.44

Lanka is good recent example. Faced with annual water shortages in their village due to drought and a desperate daily struggle to collect water from the next nearest water source six and a half kilometres away over hilly terrain, the women of Wanaraniya decided to build a dam and a permanent water pipeline into their village in July 2001. They planned the project, secured funds through a combination of loans and villager investments, and managed the technical and labour inputs, including doing or delegating the heavy construction work. Within seven months, they had a completed dam and a connected pipeline providing water to 147 houses. Since this initial launch in February 2002, the project has continued to develop and expand to provide even more families with a steady water supply[4].

Stories like these demonstrate the difference it would make to involve women in water security discussions. One of the most striking features of the Wanaraniya Water Project is its practicality. Women laid the pipeline themselves, connecting households to it based on their needs. Yet the women leading the project faced harassment when developing the project, and were even threatened by politicians.

In 2003, in an effort to tackle such challenges, an Indian-based water NGO organised a three-day national conference on the role of women in traditional water management. The conference attracted rural women from twelve different states, some of whom had never left their villages before. Using the opportunity to discuss their different experiences, the women shared strategies for maintaining local water resources and drew up a series of resolutions on water management to take back to their villages. Examples included how women in different villages had solved water shortages by learning to build water harvesting systems and reviving old tanks and ponds.

Throughout the conference, the need for women's leadership in water management was a recurrent theme. As one participant noted, "We are involved in bringing water from far-off places, using it for cooking, cleaning, washing, and

4 Ibid.

feeding animals. But when it comes to taking decisions on water management, we are nowhere[5]."

At the international and national levels, development plans often fail to reflect the priorities and needs of women. Both donors and national governments have failed to create spaces where women's voices can be heard. There is a lack of forums in which women can contribute their knowledge and concerns, resulting in the failure of genuine democratic processes in dealing with water insecurity. Lack of political voice also significantly hampers the positive contributions women can make in helping to resolve a conflict once one is underway, and reduce the chance of any solution being sustainable with a significant constituency of the affected community not having buy-in.

There are a number of remedies to this dire state of affairs.

One model which I have been personally involved in was the Water Dialogues on Water and the Private Sector, which grew out of the conflicts and protests in the late 1990s to early 2000s over the privatisation of water in densely populated urban areas of developing countries.[6] We found that the underlying problem was that the people affected were not able to influence what was happening to their water supplies. Our solution was to develop a multistakeholder group to include those that were being excluded.

The group comprised of a public water authority, an international private water utility, an international public sector trade union federation, a developing country environment campaign group and an international NGO specialising in water and sanitation. Together, we established a dialogue in five countries, involving different stakeholders on this issue (governments, utility operators, private sector, civil society, environment groups, utility trade unions, water professionals) to explore whether the private sector had a role to play in water management and achieving

5 Water and women: The flow: boloji.com/wfs/wfs137.htm
6 The Water Dialogues website: waterdialogues.org/nav-10.htm

the Millennium Development Goals (MDGs) in water and sanitation. For the first time, the dialogue provided women with substantive opportunities to contribute their understanding of and concerns over privatising water in their communities. The Dialogue also enabled different stakeholders to jointly create a new way to decide and implement water management strategies.

More importantly, it helped stakeholders previously in conflict with each other to advocate together with government authorities for their new knowledge to impact on water services policies.

The influential World Commission for Dams supports this model too. In its final report, the World Commission for Dams found that participation – including specifically encouraging the participation of women – has helped reduce conflict and made outcomes more publicly acceptable, socially legitimate, positive and sustainable because this participation recognised rights, addressed risks, and safeguarded the entitlements of all groups of affected people, particularly women and other vulnerable groups[7].

With the water sector and women in general often being marginalised in the process for developing these plans, evidence suggests that without deliberate policy actions for them, women do not automatically benefit from the proposed development interventions.

To address this deficit, the UK and other donor countries need to invest their global political capital and financial resources in two areas: a) enabling women, girls and community stakeholders to participate in national, trans-boundary and international water policy-making, through support to women's organisations and individual women to occupy positions of leadership and citizenship; and b) strengthening the capabilities of water resource management institutions to be more effective in creating space for citizen participation and downward

7 World Commission on Dams (2000), *Dams and Development: A New Framework for decision-making*. London: Earthscan Publications Ltd. p. 215, unep.org/dams/WCD/report/WCD_DAMS%20report.pdf

accountability through multistakeholder participatory deliberations. Lack of political voice for women in water resource management not only results in a democratic deficit in national and international processes, it significantly hinders the ability of communities in those countries to develop socially and economically – a key barrier to a country's stability as a state, and therefore a threat to regional and global security. In focusing on both, the UK helps promote democratic practice while also helping to achieve water security for all.

Water scarcity and global megacities

Dr. Letitia A. Obeng, Dr. Akiça Bahri and Dr. Ania Grobicki, Global Water Partnership (GWP)

The world is urbanising fast – and megacities are feeling the water pinch:

- By 2015 there will be 33 megacities, of which 27 will be in the developing world[1].
- By 2030, over 60 per cent of the world's population will be urban[2]. More than half of all Asians and Africans will live in urban areas; Latin America and the Caribbean will be more than 80 per cent urbanised.
- 43 per cent of urban inhabitants in developing countries live in slums and 72 per cent of the urban population in sub-Saharan Africa[3]. Half of the world's population is projected to live in slums by 2030[4].
- Almost half the world's population will live in areas of high water stress, where water is physically or economically scarce, by 2030[5].

Water and urbanisation

From time immemorial, large and complex cities have sprung up near water because water is crucial for all aspects of social and economic development. But the earth has never had to deal with so many dense conurbations, including megacities of over 10 million people – a larger population than many countries. Globalisation links these megacities ever closer together in a web of finance and commerce. The resource scarcities they face, especially in the case of water, are becoming acute as water demand increases and as cities search further and further away for more water.

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1 Abhat, *et al*, (2005). Cities of the future: Today's "Mega-cities" are overcrowded and environmentally stressed. emagazine.com/view/?2849

2 UN World Water Development Report (UNWDR) (2006). 2nd World Water Development Report

3 UN-Habitat, in United Nations Population Fund (UNFPA) (2007). State of world population 2007 – Unleashing the Potential of Urban Growth. unfpa.org/swp/2007/presskit/pdf/sowp2007_eng.pdf

4 UNFPA, 2007

5 Organisation for Economic Co-operation and Development (OECD) (2008). OECD Environmental outlook to 2030.

As populations grow and rural-urban migration increases, so does the demand for water. Metropolitan areas have traditionally drawn people in search of improved livelihoods. While cities confer multiple benefits for national development, rapid urbanisation is also a challenge. Cities are tasked with supporting population growth with new economic opportunities and more public services, including water and sanitation. In doing so, ensuring that the poorest are not excluded is a key challenge.

At present, urban economies face financial, political and other institutional weaknesses that undermine the integrity of their endowments. Because water is so crucial to all development sectors, city managers need to make it available as economically as possible. This is a herculean task for megacities which have to serve a growing number of slum/peri-urban dwellers in addition to those living in planned areas, especially where water is scarce. Many dry megacities from Gauteng to Karachi to Los Angeles source their water from increasing distances at increasing cost. And although slum and peri-urban dwellers often consume the least water, energy and other resources, they bear the brunt of resource mismanagement.

There is no 'one-size-fits-all' solution to the water resources management issues faced by megacities in developing countries. While freshwater is a stubbornly local and regional resource, bright ideas and innovative solutions are needed globally, embracing the global phenomenon of growing megacities. Crucially, what we have learned is the importance of understanding the demand for water across social and economic sectors with respect to its sourcing, sharing and management — and to do these with all stakeholders as equal partners in the process.

Water scarcity

The water sector in developing countries is often overwhelmed by demands from exploding urban populations[6]. Large cities, especially megacities, become 'hot spots' for water-related challenges, especially water scarcity. This can take the form of either

6 Varis, *et al,* (2006). Megacities and water management. International Journal of Water Resources Development, 22: 2, 377-394. Taylor and Francis.

a lack of availability (physical scarcity) or a lack of access (economic scarcity[7].) A lack of water often plagues the one-third of megacity inhabitants who reside in arid and semi-arid areas[8]. They rely more and more on marginal-quality waters which are unusable unless treated and require specific management strategies.

To redress shortages, megacities make use of large-scale transfer schemes that convey water from rural agriculture, ecological reserves and surrounding aquifers[9]. Agricultural water use is often singled out as the culprit behind inadequate urban water supplies. But a comparative study of megacities shows that urban water needs are invariably prioritised over water demands in outlying areas, despite the negative consequences this may cause[10].

With industrial and domestic water demand expected to double by 2050[11], competition among urban, peri-urban and rural areas is likely to worsen. However, there are many possibilities for treatment, recirculation and reuse of urban water which could alleviate the stresses. For instance, the use of such 'reclaimed water' could significantly alleviate the pressures now facing agriculture water management. Similarly, many more industries could reuse treated effluents, be they of industrial and/or domestic origin.

Wastewater

Megacities create record quantities of human waste and wastewater, adding to the strain on sanitation services[12] and on the search for freshwater. About two-fifths of the world's population does not have access to adequate sanitation[13]. Nearly

7 Molle, F., and Berkoff, J., (2006). Cities versus agriculture: Revisiting inter-sectoral water transfers, potential gains and conflicts. Comprehensive Assessment Research Report 10. Colombo, Sri Lanka: Comprehensive Assessment Secretariat.
8 Abderrahman, W., (2000). Urban water management in developing arid countries, Water Resources Development, 16, pp. 7–20.
9 Molle and Berkoff, 2006
10 Ibid.
11 United Nations Development Program (UNDP) (2006). Human development report 2006 - Beyond scarcity: Power, poverty and the global water crisis. hdr.undp.org/en/media/HDR06-complete.pdf
12 UNESCO-World Water Assessment Program. (2009). The United Nations World Water Development Report 3: Water in a Changing World. UNESCO and Earthscan.
13 World Health Organization (WHO) and United Nations Children's Fund (UNICEF) (2006). Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade. WHO/UNICEF.

80 per cent of the unserved are in sub-Saharan Africa, Eastern Asia and Southern Asia[14].

Megacities can be likened to vast living organisms. Their 'metabolism' is such that water overshadows other inputs in volume – including fuel (oil, natural gas, motor fuel) and food[15]. An estimated 80 per cent of water used in cities returns polluted to sewers; yet, a mere 10 per cent of wastewater is treated and reused in developing countries[16]. Large volumes of sewage and industrial wastes are discharged untreated into water bodies[17]. As a result, surface and groundwater become contaminated, thereby worsening water scarcity. They are also used, untreated, to irrigate vegetables, rice and fodder for livestock, generating health-related risks.

Climate change

Climate change is likely to place further pressure on water resources. The need for urban water management systems that are resilient and adaptive is even greater given the likely decline in water availability and the escalation in competition between water users. Investments are needed to develop technologies that provide better water-use efficiency.

Among key adaptation options for megacities to consider in addressing increasing water scarcity are:

- water storage facilities from large to small, both natural and artificial
- rainwater harvesting
- new water transfer schemes which pump water from often distant rivers and aquifers to cities

14 World Water Forum (4WWForum) (2006). Water Supply and Sanitation for All. Financing wastewater collection and treatment in relation to the Millennium Development Goals and World Summit on Sustainable Development targets on water and sanitation, Governing Council of the United Nations Environment Programme (UNEP), 8th Special Session/Global Ministerial Environment Forum.

15 Hermanowicz, S.W., and Asano, T., (1999). Abel Wolman's 'the Metabolism of Cities' Revisited: A Case for Water Recycling and Reuse, Water Science & Technology, Vol., 40, No. 4-5, pp. 29-36, 1999.

16 UNEP (2003). Water resources management in Latin America and the Caribbean. Contribution of the Inter-Agency Technical Committee to the 14th Meeting of the Forum of Ministers of the Environment of Latin America and the Caribbean (Panama; November 2003). Cited in Molle and Berkoff, 2006

17 United Nations (2002). World Urbanization Prospects: the 2001 Revision.

- further irrigation development
- water demand management – by encouraging people and businesses to use water more efficiently
- water reclamation and reuse
- water reallocation among sectors
- changes in water use within sectors

The suitability of these and other options depend upon the circumstances of individual cities. In Mexico City, for instance, further infrastructure construction to bring more water to the area is neither socio-economically feasible nor environmentally sustainable[18].

Water reclamation and reuse

Water reclamation and reuse are essential elements of any sustainable urban development strategy. The vicious circle of urbanisation and resource depletion is prompting the design of virtual circles: closed-loop systems. Such systems treat wastewater, and beneficially reuse the reclaimed water and inorganic and organic materials in agriculture, industry and other sectors. In the process, they contribute to the improvement of the human and environmental health of cities while supporting their own economic activities[19]. This creates a multiplier effect whereby a given volume of water can be made to work harder and become more productive.

Technological innovation is enabling water reclamation and reuse in novel ways. Advanced membrane and nanotechnologies are increasingly low-cost and energy-efficient. 'Green infrastructure' that incorporates ecological functions into landscape design – such as natural or nature-mimicking systems to treat polluted water – represent best practice in urban planning. Crucially, these technological changes must be supported by simultaneous transformation in behaviour, attitudes, institutions – including laws and regulation – financing mechanisms, professional cultures and training programmes[20].

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18 Tortajada, C., (2003). Water management for a megacity: Mexico City Metropolitan Area, Ambio, 32, pp. 124–129.
19 Brown, P. (2009). The changing face of urban water management. Water 21. February 2009, pp. 28–30.
20 ibid. Asano, 2005

Sustainable Water Management

As populations and the demand for water for basic human development activities increase around the globe, water scarcity will increase. It is imperative for managers and decision-makers in megacities to take action now to:

- develop comprehensive policies and strategies for prioritising sharing and managing available resources, taking into account multiple stakeholder demands
- keep the multiple water use sectors engaged in analyses, choices and decisions related to sustainable management of the resource
- ensure that choices around new water sourcing for megacities do not adversely impact the water needs of the rest of the country and its development as a whole
- foster a culture of long-term planning that looks beyond short-term financial calculations and takes seriously the implications for sustainable environmental management
- invest in both 'soft' (institutional development and growing human capacity) and 'hard' (large and small infrastructure) sustainable solutions, especially closed-loop systems

Investing in sustainable water management contributes to long-term social and economic development, environmental resilience and good governance.

Fish and foul: Biodiversity impacts in a drying world

Richard Black, BBC News

In search of a new world

A century ago, Europeans travelled to Australia to see what life could be like in a new world far from the trammels of class-ridden societies and lands crammed with people.

Now, some are going to see a preview of a different kind of new world – one where the demands of people for freshwater are greater than ever, yet the supply is increasingly constrained, and nature is caught in the middle. It is a world that most of us will inhabit to a greater or lesser extent in the coming decades.

The earliest settlers brought agriculture to the south-eastern states of New South Wales and Victoria and the abutting eastern portion of South Australia. Subsequently, farming expanded, irrigation spread, cities rose from marsh and scrub; and watering all of this was the Murray-Darling basin, the complex that includes the country's three longest rivers. This one river system accounts for about 40 per cent of the nation's agriculture[1].

When water use exceeds sustainable limits

But the last decade has given southern regions of Australia a prolonged period of drought[2]. The rivers are under enormous strain, as temperatures rise and precipitation declines. Water extraction is beyond sustainable limits[3]. With no decline likely in volumes needed for drinking, and with higher temperatures forecast to increase evaporation losses still further, what will be left for wildlife and ecosystems?[4]

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1 The Murray-Darling Basin Authority (MDBA): About the Basin – mdba.gov.au/water/about_basin
2 Commonwealth Scientific and Industrial Research Organisation (CSIRO) – Climate change, climate variability and drought in eastern Australia - csiro.au/science/climate-and-drought-in-eastern-Australia.html
3 MDBA: Issues paper – Establishment of Sustainable Diversion Limits for the Murray-Darling Basin – mdba.gov.au/files/publications/sustainable-diversion-limits-issues-paper-12-11-09.pdf
4 Climate Change in Australia – projections for Victoria - climatechangeinaustralia.gov.au/victemp1.php

The region is home, for example, to more than 20 Ramsar sites[5] – wetland areas of international importance. They form crucial habitats for migrating waterbirds, and are also important to a healthy regional ecology.

In the recent drought, authorities blocked water flow into some of these wetland areas[6]. This is seen as a management option that reduces evaporation from the basin as a whole. But, as the Murray-Darling Commission acknowledges, wetlands that remain closed for long periods are "at risk of deteriorating ecologically… some wetlands may become acidified or salinised if they are disconnected and dried out." The exceptionally dry decade and the subsequent closures come on top of many previous decades that have seen the natural flow into and out of wetlands changed by dams, weirs and canalisation of watercourses.

Successive investigations of impacts on The Coorong – a large lagoon – and its associated lakes found significant changes to local ecology, with numbers of waterbirds – notably the pelicans immortalised in the children's book *Storm Boy* – down below a third of their historical level, while briny shrimp lay dead and rotting along the shore in the absence of their natural predators. An expert submission to a senate inquiry in 2008, which summed up these changes, contained the ringing passage:

> "*A time bomb may be released if lake levels stay low for a sufficient period, exposing soils to air and allowing the oxidation of sulfides contained in these lakeshore and floor sediments.*
>
> "*The capacity of present lake water to buffer persistent acid influx will decline with time, converting the remaining waters of Lakes Alexandrina and Albert into water like battery acid.*"[7]

It was not that authorities were unaware of the problem. They had dredged out the mouth of the Coorong and had agreed that it must have a net inflow each year. But what were they supposed to do – take water away from people to preserve wetlands?

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5 Ramsar Sites Information Service – ramsar.wetlands.org

6 MDBC factsheet – drought contingency measures (2007) – mdbc.gov.au/news/drought_contingency_measures_ may_2007.html

7 Senate Inquiry into the Urgent Provision of Water to the Coorong and Lower Lakes – submission by the Wentworth Group of Concerned Scientists – wentworthgroup.org/docs/Senate_Submission_Response_to_the_Coorong_Crisis1.pdf

Confronting the challenge

The Australian government's projections show average temperatures here increasing by at least one Centigrade, possibly two, by 2030 compared with 1990.[8] Rainfall is forecast to decrease, and the frequency of hot and dry years to increase. If that scenario plays out, hoping that the previously abundant flows will return is simply a mirage. Planners have to set new rules and put new methodologies in place. Hard questions are being asked; the changed physical world is forcing farmers to leave their land[9]. Most intriguingly, a 'water market' is now in operation, whereby users such as farms can bid for the right to extract.[10] The Australian Conservation Foundation has raised funds to buy water to replenish the Hattah Lakes wetlands in Victoria, an area that regularly hosts 20,000 waterfowl each year, as well as providing habitat for locally threatened plants and amphibians.[11]

The Murray-Darling basin provides an excellent testbed of how a society can respond to serious water shortage. The dimensions of the issue are transferable and scalable – the needs of infrastructure and society grown on high water availability, the pervasive pressure on natural ecosystems. Because Australia is a developed country, there is good scientific awareness of the problem, a healthy civil society monitoring its dimensions and a raft of possible policy options on the table. What choices it makes, and how human society and wetland life emerge, will help inform many other choices to be made around the world.

There is no doubt that constraints on freshwater availability pose a major threat to many species and ecosystems in a warming world with a burgeoning human population, just as they pose a threat to that population itself. Amphibians are one group of animals that is globally impacted[12]. One-third are on the Red List of Threatened Species; across all taxa, habitat loss is by far the most significant driver of decline[13]. With many

8 Climate Change in Australia (Ibid.)
9 Sydney Morning Herald, Parched farmers vote to abandon irrigation – smh.com.au/environment/water-issues/parched-farmers-vote-to-abandon-irrigation-20100325-qzvp.html
10 Australian Environment Ministry, Water entitlement purchasing in the Murray-Darling Basin – environment.gov.au/water/policy-programs/entitlement-purchasing/index.html
11 Australian Conservation Foundation, ACF doubles the amount of water it will buy for wetlands – acfonline.org.au/articles/news.asp?news_id=2758
12 International Union for the Conservation of Nature (IUCN) Red List: Amphibians - hiucnredlist.org/initiatives/amphibians
13 IUCN Red List: Amphibians – Major Threats - iucnredlist.org/initiatives/amphibians/analysis/major-threats

amphibians limited to small geographical areas, and many dependent on watercourses for all or part of their lifecycles, the draining of just one area can lead to extinction. In the US, for example, the water demands of the desert hedonopolis of Las Vegas led directly to the demise of the Las Vegas leopard frog, Lithobates fisheri[14].

Often, modification of rivers and lakes impinges on reproduction, as with the Japanese giant salamander, whose territory is now restricted by dams and weirs[15]. This fragments populations, reducing genetic diversity within each new sub-population and increasing vulnerability to other threats.

Across the developing world especially, there are many examples of ecosystems where numerous water-related threats are operating in conjunction. The most spectacular is the concentration of threats along the Yangtze (the longest river in Asia and the third longest river in the world), where a combination of pollution, diversion, shipping, hunting, over-fishing and over-extraction almost certainly pushed the baiji into history a few years ago[16]. Globally, about 20 per cent of freshwater fish have either become extinct or are currently threatened with extinction[17]; some authors believe this to be an underestimate.

As well as wetlands and rivers, lack of water threatens forests, even the mighty Amazon. Dry summers in 2005 in south-western Brazil left communities having to count water for the first time in living knowledge[18]. Nobody, at that time, was counting the cost in terms of trees and fauna; that there must be a cost, however, is axiomatic[19].

Taking action

In an attempt to persuade policymakers of the value of keeping species and natural systems intact, conservation institutions are ramping up efforts to calculate the economic

14 IUCN Red Listing for *Lithobates fisheri* – iucnredlist.org/apps/redlist/details/19148/0
15 BBC News, Giant salamander – Human threat, human promise - news.bbc.co.uk/1/hi/sci/tech/8498023.stm
16 IUCN Red Listing for *Lipotes vexillifer* – iucnredlist.org/apps/redlist/details/12119/0
17 Convention on Biological Diversity (CBD), Status and Trends of Biodiversity of Inland Water Ecosystems (2003) - cbd.int/doc/publications/cbd-ts-11.pdf
18 BBC News, Amazon drought emergency widens – news.bbc.co.uk/1/hi/world/americas/4344310.stm
19 Zeng et al (2008): Causes and impacts of the 2005 Amazon drought – Environmental Research Letters – iopscience.iop.org/1748-9326/3/1/014002?ejredirect=migration

costs and benefits of preserving and restoring them, as opposed to exploiting them beyond redemption. The biggest project is The Economics of Ecosystems and Biodiversity (TEEB), started in 2007 under the German G8 presidency.[20] Already it has valued the economic cost of global forest destruction at US$2-5 trillion each year; subsequent reports will include freshwater systems.[21] Other, smaller-scale analyses have already produced economic arguments in favour of preserving ecological balance in water systems. WWF has calculated the average value of wetlands, in terms of the services they provide (such as flood control and recreation), at about US$70bn per year[22].

Where wetlands and rivers provide such services, the logical route to protecting them is to have the users pay for those services – the concept of Payment for Ecosystem Services (PES). It is already a reality in some areas. In Bogota, Quito and New York, water utilities are investing in ecosystem preservation because in the end, it saves them money; nature can provide clean water more cheaply than chemical-based treatment works[23]. Along the Yangtze valley, a partnership between the government and WWF has re-connected fragments of watercourse, resulting in a number of economic benefits including increased availability of fish.

In all of these examples, ecosystems and biodiversity benefit as well as people. Backers of the TEEB report, which include the UN Environment Programme and the German and UK governments, hope that its dissemination shortly before the 2010 Convention on Biological Diversity meeting in Japan will galvanise governments into action on PES in the same way that the 2006 Stern Review brought new economic dimensions to governments' analyses of climate policy options.

But PES is not a complete barrier against further water-related impacts on the natural world. For one thing, it only works if the economic case for protection is better than the economic case for business-as-usual exploitation, which will not always be the case. Secondly, not all biodiversity brings economic rewards; and components that do

20 The Economics of Ecosystems and Biodoversity – teebweb.org
21 BBC News, Nature loss 'dwarfs bank crisis' – news.bbc.co.uk/1/hi/sci/tech/7662565.stm
22 WWF, The Economic Value of the World's Wetlands (2004) – assets.panda.org/downloads/wetlandsbrochurefinal.pdf
23 Swedish Water House, WWF, IUCN et al, Securing Water for Ecosystems and Human Well-being: The Importance of Environmental Flows – cmsdata.iucn.org/downloads/securing_water_for_ecosystems_and_human_well_being.pdf

not, will receive no protection under PES-based policies. Nevertheless, already there are national and international markets for biodiversity offsets, and it is possible that at some stage something more rigorous, structured and genuinely global will emerge, in the same way that a global carbon market could develop[24].

Poor people hit first and worst

If there is one central message emerging from the TEEB review thus far, it is that degradation of the natural world impacts the poor far more than the rich[25].

And it is here that we find the issue's most obvious foreign policy dimension. If nations fight future wars over water – a common assumption, albeit one perhaps not backed up by data[26] – it is not going to be because Country A's extraction has sent Country B's population of flamingos into extinction. It is going to be because of the impact on people. But if the absence of flamingos through water stress – or more likely, the absence of edible frogs or fish or pollinating insects – degrades peoples' nutrition or income, wars and conflicts could result, with an even greater likelihood of mass hunger and all the developmental blockages that this implies.

A number of aid agencies, including the UK's Department for International Development (DfID), now take climate change into account when planning their aid programmes. DfID money goes to providing climate-resilient 'keyhole gardens' in Lesotho and to building schools on stilts in Bangladesh as protection against floods[27, 28]. Part of the reasoning is ethical, but a larger factor is simply that this is judged to be a cost-effective parameter for delivering aid.

As evidence from TEEB and similar initiatives comes in, it is likely that aid agencies will increasingly also take considerations of ecosystem services into account when planning and delivering projects. This is something that International Union for

24 UN Food and Agricultural Organization (FAO): Payments for Ecosystem Services from Agricultural Landscapes – fao.org/es/esa/pesal/ESmarkets7.html

25 BBC News, Nature loss 'dwarfs bank crisis' (ibid)

26 BBC News, Aaron Wolf et al, Peace in the pipeline - news.bbc.co.uk/1/hi/sci/tech/7886646.stm

27 Department for International Development (DfID), Keyhole gardens help Lesotho adjust to climate change – dfid.gov.uk/Media-Room/Case-Studies/2007/Keyhole-gardens-help-Lesotho-adjust-to-climate-change

28 BBC News, UK gives Bangladesh climate help - news.bbc.co.uk/1/hi/sci/tech/7606024.stm

Conservation and Nature (IUCN) for example, advocates, on the basis of case studies showing that investing in 'natural infrastructure' such as forests, riverbanks, wetlands, etc can be economically as well as ecologically effective[29]. At times, donors are likely to find synergies between ecosystem conservation, climate protection and economic development; at other times, they may not.

Clearly, information is everything. History is littered with examples of developments that have had negative impacts simply because national policymakers and international funders had not evaluated the costs of the changes they were about to make. The Komadugu Yobe dams in Nigeria, built in the 1970s, diverted supplies from watercourses that supported edible fish and provided water for livestock, to such an extent that conflicts became routine – conflicts that could, in a different region, have run across international boundaries[30]. Realisation of this has led, 30 years later, to restoration of the watercourses, at a cost that could have been saved with adequate information in advance.

To be forewarned is to be forearmed

A number of tools have been developed such as ELOHA – the Ecological Limits of Hydrologic Alteration[31] – that in principle allow for quantitative analysis of the water flow that must be retained if impacts on ecosystems are to be kept within prescribed parameters. But a considerable degree of understanding of ecological relationships is necessary for such tools to be used, and it is perhaps in developing this understanding that donors will choose to invest first.

The impacts of water scarcity on biodiversity and ecosystems, then, are but components of the wider impacts that modern society is visiting on the natural world as our numbers soar, as our hunger for natural resources grows and as our greenhouse gas emissions change the climate. Through water, these impacts will necessarily impact the poor who live close to nature far more than the rich who are insulated from it. For some wetland ecosystems, the changes are probably irreversible already, as they definitely are for some species.

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29 IUCN, Environment as infrastructure – Resilience to climate change impacts on water through investments in nature – cmsdata.iucn.org/downloads/iucnperspap_environment_as_infrastructure.pdf

30 IUCN, Environment as infrastructure (Ibid.)

31 ConserveOnline, The Eloha Toolbox - conserveonline.org/workspaces/eloha

Today, the earth's environmental resources are increasingly under enormous strain. Nowhere is this stress more apparent than in the case of the earth's finite supplies of freshwater. Less than three per cent of the earth's water is potable and 2.5 per cent of this freshwater is inaccessible, locked up in Antarctic and Arctic ice sheets and glaciers. The vast majority of freshwater that is accessible is secured through ground water sources, rainfall and natural lakes. In addition, fewer than 10 countries hold 60 per cent of the world's available freshwater supplies: Brazil, Russia, China,Canada, Indonesia, U.S., India,Columbia and the Democratic Republic of Congo.

How can access to freshwater be secured when and where it is needed, and how can the competing demands for freshwater from the environment, agriculture, industry and households be more effectively managed? More importantly, in an increasingly interconnected world where co-operation is not just an option but an absolute imperative, how can future foreign policy tackle the challenges thrown up by the world water crisis?

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