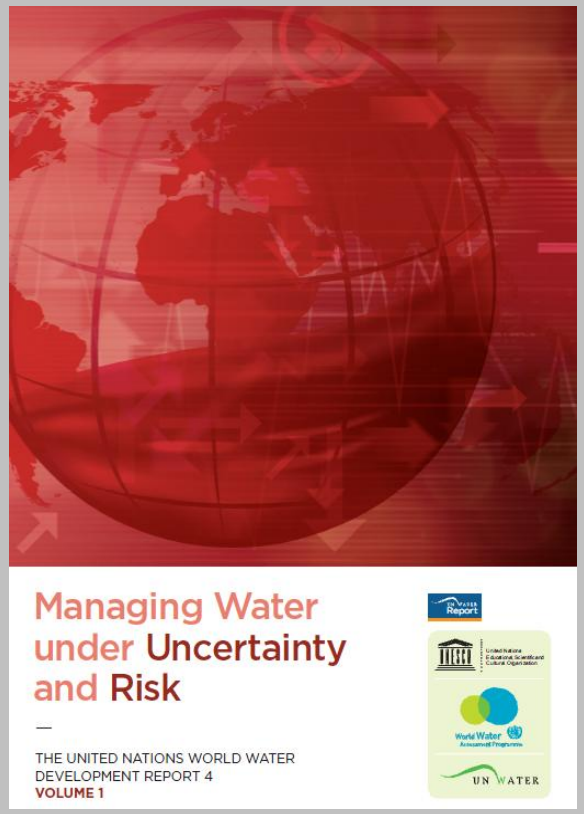
# WWDR4






# Managing Water under Uncertainty and Risk

*Olcay Ünver, Coordinator,*
*UN World Water Assessment Programme*

“Increasing demand and climate change threatening world water resources says new UN World Water Development Report” *Feb 28, press*

*Unprecedented growth in demands for water are threatening all major development goals, warns the latest edition of the UN World Water Development Report, Managing Water under Uncertainty and Risk. It notes that rising food demand, rapid urbanization and climate change are significantly increasing pressure on global water supplies. This complex situation requires a radical rethink of the way water is managed.*

- Report estimates that the world will need 70 per cent more food by the middle of the century, with demand increasing especially for livestock products. A surge in food production will lead to an increase of at least 19 per cent in the water required for agriculture, which already accounts for 70 per cent of freshwater use.
- Report warns that these figures could climb even higher if agricultural efficiency does not improve significantly.

# WWDR4 HIGHLIGHTS THE UN WORKING AS ONE

Convention on Biological Diversity

IAEA

IFAD
Enabling poor rural people to overcome poverty

unicef

UNITED NATIONS
UNCTAD

UNCCD

UNDESA, UNECA, UNECE, UNECLAC, UNESCAP and UNESCWA

UNDP

UNESCO
United Nations Educational, Scientific and Cultural Organization

UNEP

United Nations
Climate Change Secretariat

UN HABITAT
FOR A BETTER URBAN FUTURE

UNHCR
The UN Refugee Agency

UNIDO

ISDR
International Strategy for Disaster Reduction

UNITED NATIONS UNIVERSITY

THE WORLD BANK

World Health Organization

World Meteorological Organization

UNWTO

ILO

unitar
United Nations Institute for Training and Research

UNESCO
United Nations Educational, Scientific and Cultural Organization

World Water Assessment Programme

UN WATER

# WWDR4 AUDIENCE

Recent UN-Water survey shows that the WWDR is used extensively for:

- self learning, - educational support,
- advocacy and policy development ,
- drawing on the lessons learned presented in the report

# WHAT IS NEW IN WWDR4?

- Comprehensive scope: 17 areas/topics/sectors
- New regional component
- Holistic within and outside *the water box*
- Glimpses into possible futures
- Gender-mainstreamed
- Thematic focus: ‘Managing water under uncertainty and risk’

# WWDR4 volume 1


- Overview of recent developments, emerging trends and key challenges w.r.t:
  - Demands
  - The Resource
  - Benefits
  - Management & Institutions
  - Data & Indicators

- The external forces driving these and the uncertainties and risks created by the drivers.

- Examination of these from a regional perspective.

# Chapter 1: Recognizing the centrality of water and its global dimensions

- Water for irrigation and food production: one of the greatest pressures on freshwater resources (70% globally).

- Global population growth: 2–3 billion more people during next 40 years; changing diets lead to a predicted increase in food demand of 70% by 2050.

- Natural hazards: socioeconomic impacts occur through water. Damage representing 2–15% of annual GDP in developing countries.

- Water and Energy: of all energy produced globally, 7–8% is used to lift groundwater, pump it through pipes, and to treat both groundwater and wastewater (can be as high as 40% in developed countries).

# Chapter 1: *Beyond the basin, the international and global dimensions*

Climate Change: Investment needed to tackle a 2°C rise could range from billion US$70-100 per year between 2020 and 2050. Of this cost, billion US$14-19.2 is related to water, predominantly through water supply and flood management.

Transboundary Issues:

*Surface water:*148 states have international basins within their territory, and 21 countries lie entirely within them. 65% of the world's 276 international river
basins lack any type of cooperative management framework.

*Groundwater:* About 2 billion people worldwide depend on groundwater supplies, which include 273 transboundary aquifer systems.

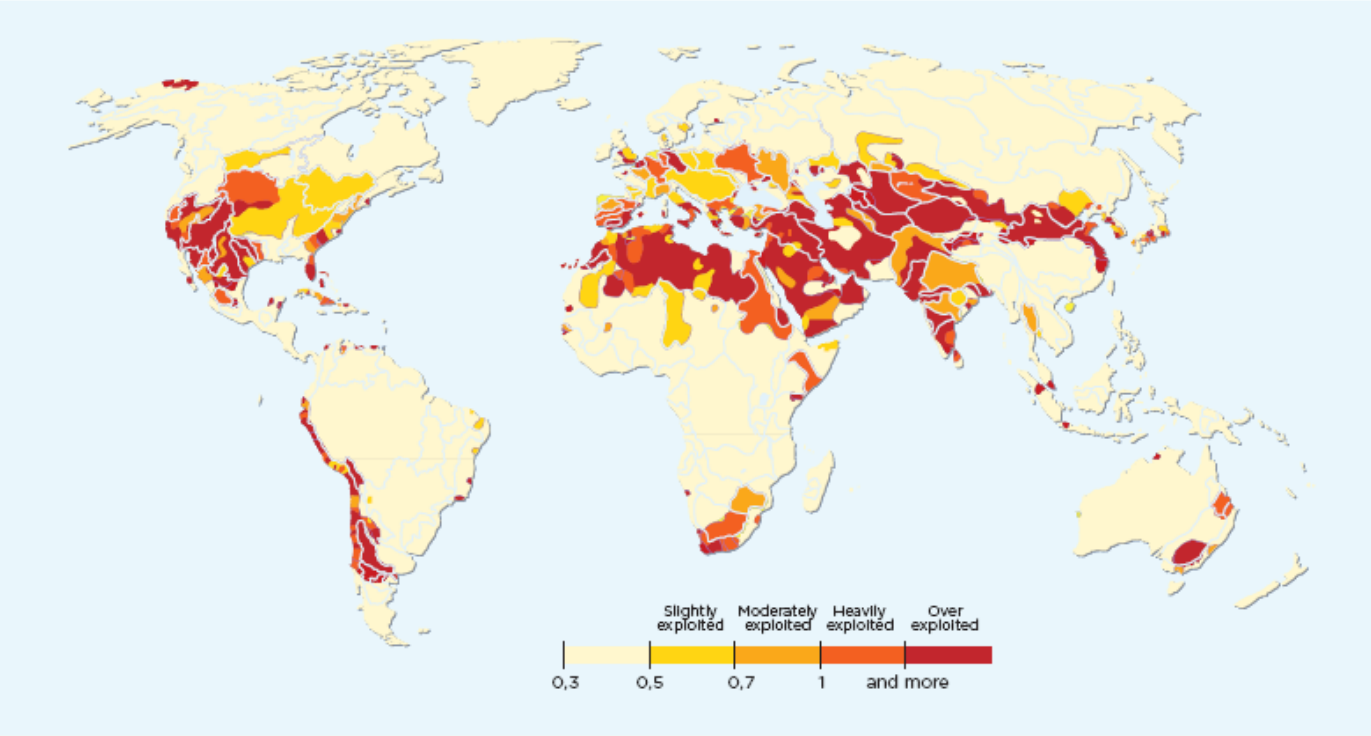
# Chapter 1: *Beyond the basin, the international and global dimensions*

Meeting Food and Energy Demands: With population growth, by 2030, food demand is predicted to increase by 50% (70% by 2050) and energy demand by 60% over next 30 years. These issues are interconnected. Increasing agricultural output, for example, will substantially increase both water and energy consumption, leading to increased competition for water between water-using sectors.

Biofuels are an increasingly prominent component of the energy mix. If by 2030 just 5% of road transport is powered by biofuels, this could amount to at least 20% of the water used for agriculture globally.

FIGURE 4.9

Global Water Stress Indicator (WSI) in major basins




*Source: UNEP/GRID-Arendal (2008) (http://maps.grida.no/go/graphic/water-scarcity-index, P. Rekacewicz [cartographer], with sources Smakhtin, Revenga and Döll [2004]).*

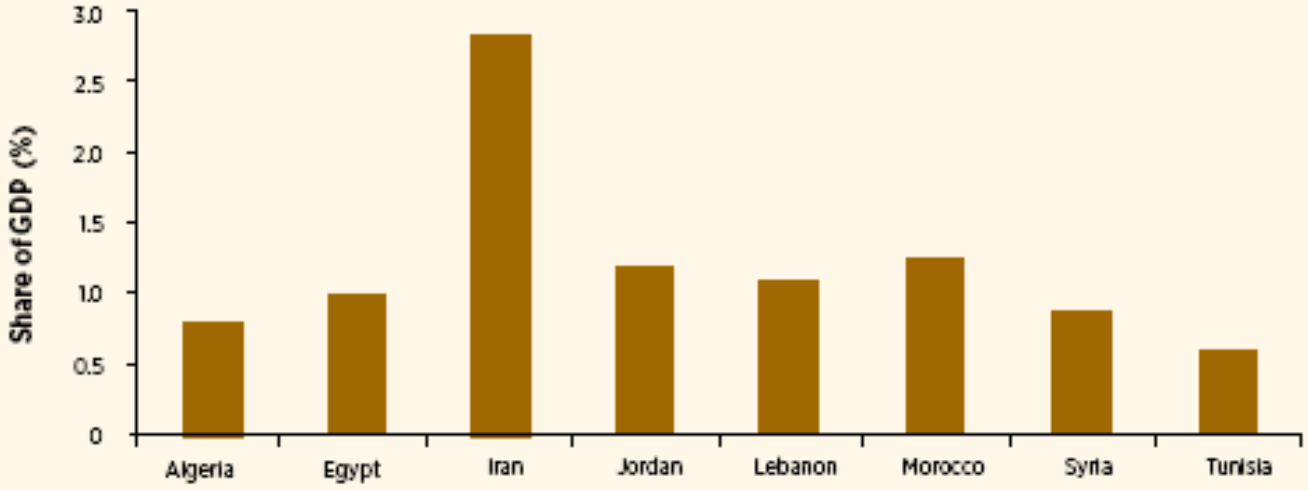
**FIGURE 2.9**

Ratio of treated to untreated wastewater discharged into water bodies


*Note: Ratio of wastewater treatment (March 2010).*
*Source: UNEP/GRID-Arendal (http://maps.grida.no/go/graphic/ratio-of-wastewater-treatment), adapted from a map by H. Alhenius with sources UNEP-GPA [2004]).*

**FIGURE 3.16**

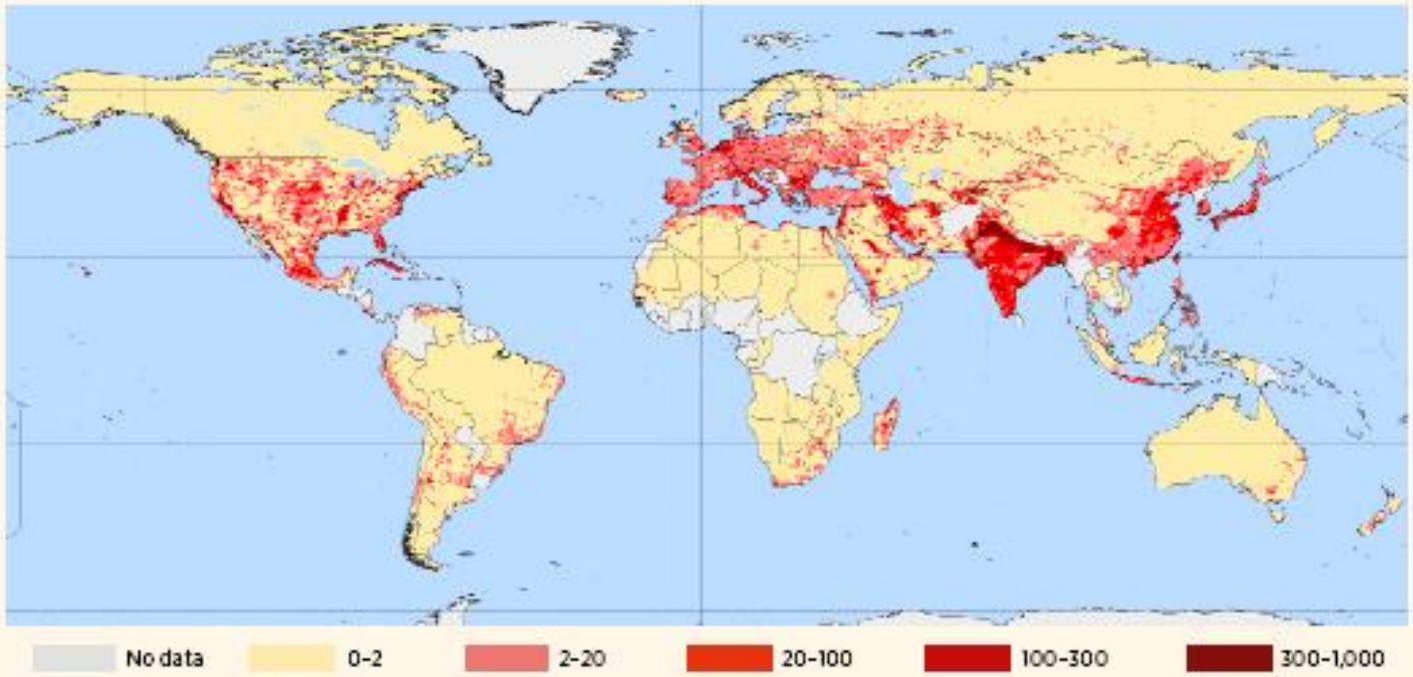
Annual cost of the environmental degradation of water



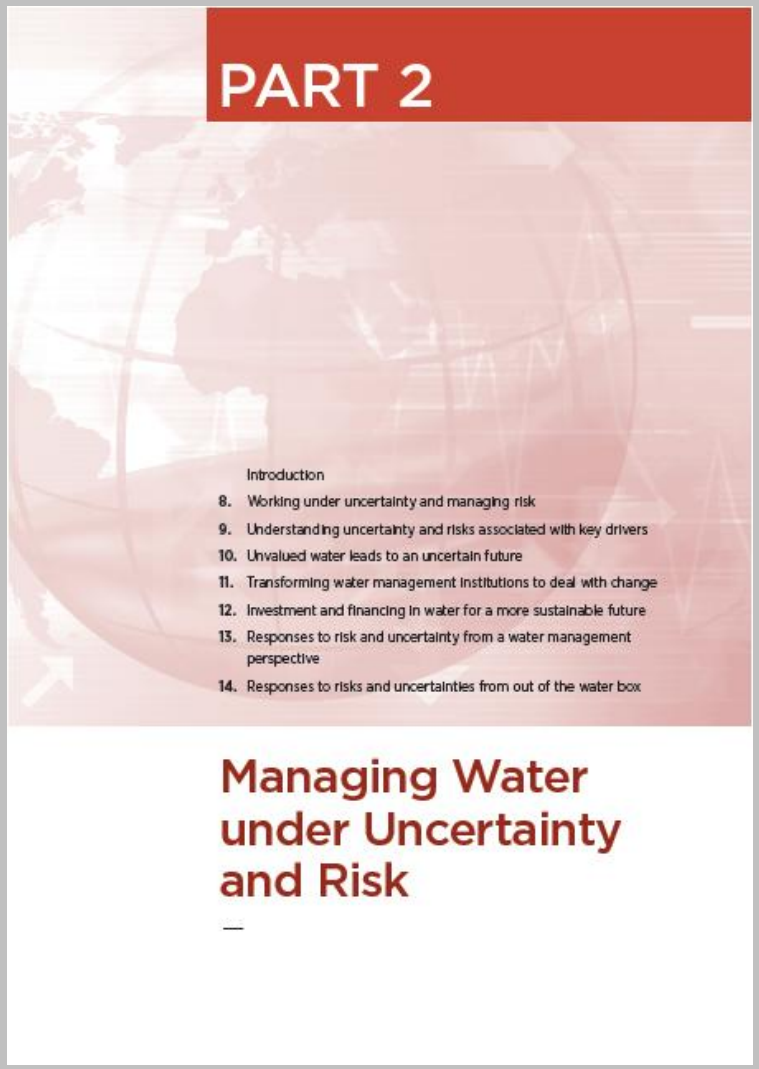

*Source: World Bank (2007, fig. 4.4, p. 109, from data sources cited therein).*

**FIGURE 3.7**

Intensity of groundwater abstraction by the year 2000 (in mm per year), as allocated to 0.5° x 0.5° grid cells by the PCR-GLOBWB model




*Source: Wada et al. (2010, p. 2, © American Geophysical Union, reproduced by permission).*



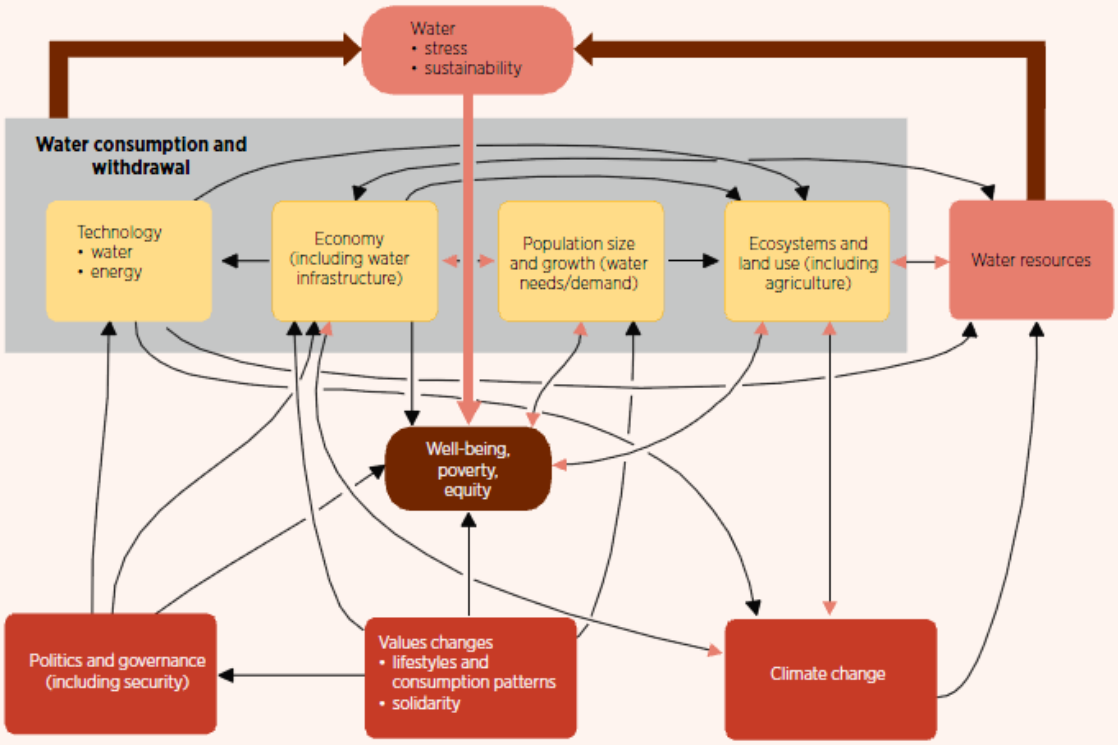

**Part 2: 'Managing water under uncertainty and risk'**

The thematic part of the report in which issues are investigated through the lens of risk and uncertainty, with particular emphasis on climate change and other drivers of change.

Illustrations of how water managers and other decision-makers have responded to these challenges show the range of available options.

**FIGURE 9.1**

**Key drivers and causal links affecting water stress and sustainability and human well-being**




*Source: Gallopiin (2012, fig. 2, p. 8).*


## *Chapter 13 – Responses to risk and uncertainty from a water management perspective*

- Reducing uncertainty
- Reducing exposure and minimizing risks
- Living with uncertainty and risk: Trade-offs in water decision-making

# Reducing uncertainty

- **Generating knowledge** – Monitoring, Modeling and Forecasting: Integrated Water Resources Optimization Models
- **Adapting Planning**: Examples of river basin flooding (e.g. UK's 'Making Space for Water' program uses ecosystems instead of engineered infrastructure), urban flooding and dryland rehabilitation
- **Proactive Management**: Farmer managed GW systems in Andra Pradesh, India.

# Reducing exposure and minimizing risks

- **Environmental engineering**:

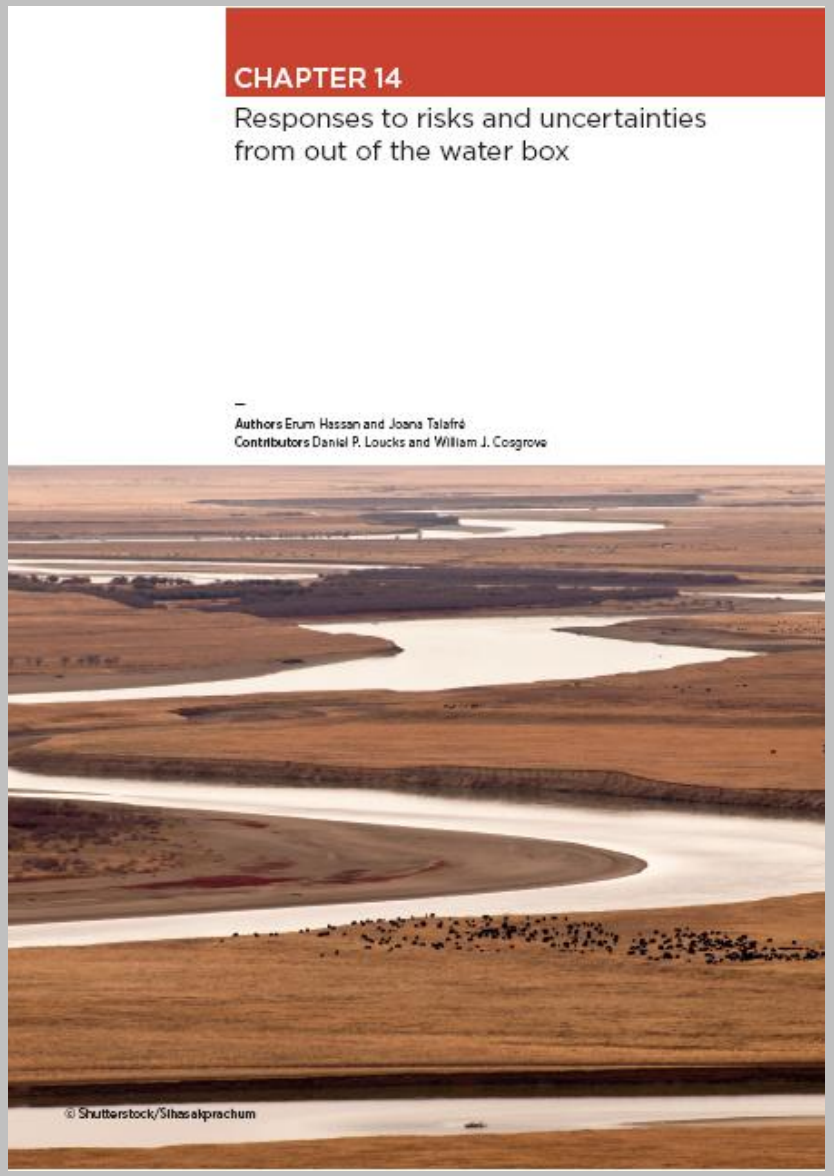
Mangrove restoration in Vietnam to mitigate against coastal flooding (storms, sea-level rise)

Constructed wetlands for wastewater treatment in Bayawan City, Philippines

Investment in infrastructure (obvious but expensive)

# Trade-offs in water decision-making

**Ensuring reliable access** to water for industrial purposes while providing a key pollution control service: Dow Chemical uses municipal household wastewater, which uses less energy to treat than the local brackish water in the area.




## *Chapter 14 – Responses to risks and uncertainties from out of the water box*

- Reducing poverty and greening growth and economies
- Responding to climate change: adaptation and mitigation
- Business decisions to reduce risk and uncertainties
- Managing sectoral risks to generate benefits for water
- Mitigating risks and uncertainties

# Responses to risks and uncertainties outside the water box

**Reducing poverty and greening growth and economies**

Cuba uses organic agriculture for sustainable growth (eliminating pesticides and chemical fertilizers allows the maintenance of high levels of water quality whilst generating direct health benefits)

**Responding to climate change: adaptation and mitigation**

Reducing Emissions from Deforestation and Forest Degradation (REDD) with water co-benefits

# Business decisions to reduce risk and uncertainties

- **Restoring water provision** in a dry area: Italcementi (illustrates how a business decision, initially motivated by profit and the need to access natural resources for production, has helped to reduce risks and uncertainties related to future water scarcity by providing an additional water reserve for communities and the environment)

- **Implicit valuation** reduces business and water risks (Rio Tinto in Australia: creating a ‘valuation hierarchy’ for using different sources at different times – example of a ‘robust’ approach ensuring sustainability of both the resource and the business operation)

# *Responses to risks and uncertainties from out of the water box*

**Managing sectoral risks to generate benefits for water**

• Autovias's Waterway Program decreased the need for road maintenance while helping to recharge one of Brazil's most important aquifers (on a highway, water runoff/ collection programme reduces repair costs AND recharges aquifer)

**Mitigating risks and uncertainties**

• The Caribbean Catastrophe Risk Insurance Facility (risk sharing: 16 participating small island countries pool their risks into one, diversified insurance portfolio)

# WWDR4 Volume 2


## Part 3: Knowledge base

- Comprehensive reports from challenges and regions

**CHALLENGE AREA REPORTS**

State of the Resource: Quantity and Quality
Human Settlements
Managing water along the livestock value chain
The global nexus of energy and water
Freshwater for industry
Ecosystems
Allocating water
Valuing water
Investing in water infrastructure, operation and maintenance
Water and institutional change
Developing knowledge and capacity
Water-related disasters
Desertification, land degradation and drought

**REGIONAL REPORTS**

Africa / Europe and North America / Asia and the Pacific / Latin America and the Caribbean / Arab region and Western Asia

**SPECIAL REPORTS**

Water and health / Water and gender / Groundwater

# WWDR4 Volume 3

## *Volume 3 – Facing the Challenges (15 case studies at basin and national level)*


Regional distribution of the case studies


**AFRICA**
1. Ghana
2. Kenya-Tanzania (Mara River basin)

**ARAB STATES**
3. Jordan
4. Morocco

**ASIA and the PACIFIC**
5. Australia (Murray-Darling basin)
6. China (Yellow River basin)
7. Korea (Jeju Island)
8. Pakistan (with special reference to the Indus River basin)

**EUROPE and NORTH AMERICA**
9. Czech Republic
10. France (Marseille Provence Métropole Urban Community)
11. Italy (Tiber River basin)
12. Portugal (Tagus River basin)
13. United States of America (St Johns River basin, Florida)

**LATIN AMERICA and the CARIBBEAN**
14. Costa Rica
15. Mexico (Lerma-Chapala basin)

Countries included in both Africa and Arab States Regions of UNESCO

Countries included in both Europe/North America and Asia/Pacific Regions of UNESCO

# WWDR4 MAIN MESSAGES: 1

## The centrality of water

Water underpins all aspects of development: it is the ***only*** medium that links sectors and through which major crises can be jointly addressed.

# WWDR4 MAIN MESSAGES: 2

**Increased coordination over water for meeting multiple goals**

A coordinated approach to managing and allocating water across competing sectors to meet multiple goals also helps *ensure that progress made in one sector is not offset by decline in others*.

# WWDR4 MAIN MESSAGES: 3

## Flexible institutions, adaptive management

Strong institutions and political will are needed to facilitate discussion and decisions between sectors and help balance risks.

# WWDR4 MAIN MESSAGES: 4

## Global interdependencies with local impacts

Global interdependencies will increasingly be woven through water.

If no action is taken, to meet their needs regions and sectors without enough water will need to rely more heavily on others' resources to meet them.

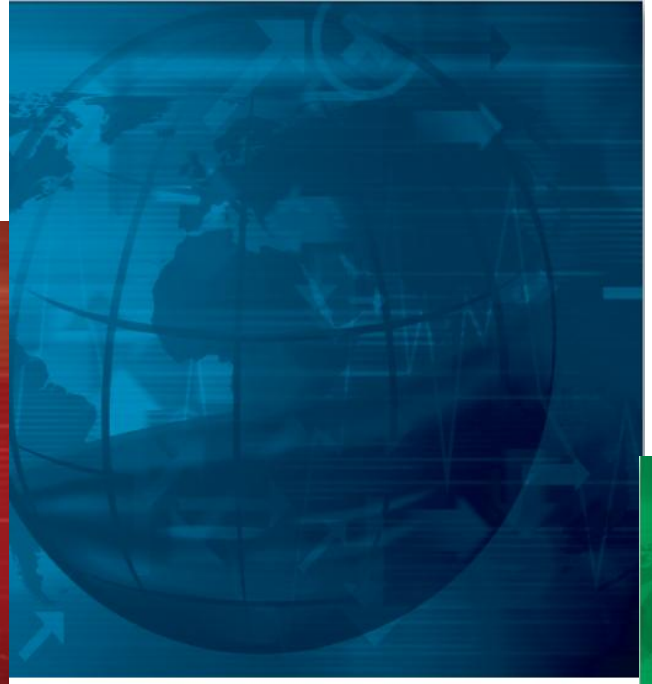
# WWDR4 MAIN MESSAGES: 5

## Concerted action and leadership from national governments

It is time for everyone to take concerted action!

- Water managers
- Leaders in government
- Civil society
- Business at local, basin, national and global levels

It is critical that ***national governments*** assume leadership and integrate water as a priority in all key policy areas within their own countries as well as through global policy tracks, such as the ***Millennium Development Goals, climate change talks and the Rio+20 process***.



*Thank you for your attention*

United Nations Educational, Scientific and Cultural Organization

World Water Assessment Programme

UN WATER

## Farmer managed GW systems in Andra Pradesh, India

The Andhra Pradesh Farmers Ground Water Management System (APFAMGS) is a community-based project involving over 28,000 men and women farmers in 638 villages across 7 drought-prone districts.

A demand-side approach to the project allows farmers to manage their water resources, understand how groundwater systems operate, and make informed choices regarding their water use. The underlying premise of APFAMGS is that sustainable management of groundwater is feasible only if users understand its occurrence, cycle and limited availability, as well collective decision-making, which will govern the resource.

## Constructed wetlands for wastewater treatment in Bayawan City

An artificial wetland was constructed to filter and transform nutrients and other constituents. The treated wastewater (97 % removal of BOD) was used initially for concrete production for construction. The effluent has almost ideal concentrations of nitrogen and phosphate to be used for ‘fertigation’ (to fertilise and irrigate). It is now used for an organic cut flower and vegetable farming project. Since November 2008 frequent and accurate analysis is conducted to analyse for faecal coliforms.

The investment in this constructed wetland infrastructure provides water resources for various economic activities, which would otherwise be compromised, thereby reducing uncertainty.

# Dow chemical and city of Terneuzen

Dow’s Terneuzen manufacturing facilities in the Netherlands require a significant amount of freshwater. Since 2007, the site accepts more than 9.9 million litres of municipal household wastewater every day. Dow has been able to cut its freshwater use in half by using the wastewater from the municipality and also through recycling efforts. Not only does Dow save money on energy, but the municipality saves on treatment, which is done by Dow. This is a win-win approach. Trade-offs don’t need to be negative)

# Cuba uses organic agriculture for sustainable growth

While ensuring national food security under a trade embargo, Cuba’s transition to organic agriculture has also had a positive impact on people’s livelihoods by guaranteeing a steady income for a significant proportion of the population. Moreover, the lack of pesticides for agricultural production is likely to have a positive long-term impact on Cubans’ well-being since such chemicals are often associated with various negative health implications such as certain forms of cancer.

# Implicit valuation reduces business and water risks

Rio Tinto Aluminium's Weipa bauxite-mining operations in Australia have multiple sources of water, each of which has its own associated costs and additional values. The four main sources are:

- Recycled or reused water from the tailings dam
- Site rainfall runoff
- Shallow aquifers underlying the area.
- The deeper aquifers of the Great Artesian Basin.

Availability of the different sources can vary during the year.

Rio Tinto identified the level of sensitivity of the shallow aquifers and the Great Artesian Basin during normal environmental risk management processes. This has been reinforced by engagement with key stakeholders, including the Great Artesian Basin Coordinating Committee and nongovernmental organizations.

These processes have aided the establishment of a formal hierarchy of sources, directing the operation to source first from tailings dams, then 'slots', then the shallow aquifers, and finally the Great Artesian Basin aquifers. The costs of these sources vary considerably. Instead of always using them in the order of cost increase, the establishment of the sourcing hierarchy effectively places an implicit value on the natural sources of water. In the case of the Great Artesian basin, the focus is on the long-term sustainability of the resource, as it has the slowest rate of recharge.

# Autovias's Waterway Program

Autovias built and manages 316.5 km of highways in Brazil's São Paulo State. Including infrastructure construction could change the landscape, leading to erosion, settling, and decreased groundwater infiltration.

Autovias has developed a project that collects water on the highways' surfaces and directs it towards the Guarani aquifer recharge zone. The company designed the program mainly to protect this vital water resource. Autovias earns no direct income from putting water into the aquifer, but the program helps decrease the need for road maintenance and prevents washouts, thus saving the company money.

Another win-win solution!