WORKING PAPER

Green Accounting and Data Improvement for Water Resources

A working paper prepared for the session 'Green Accounting and Data Improvement: Critical Tools for Informed Decision Making and Sustainable Growth' at World Water Forum 6, Marseille, 13 March 2012.

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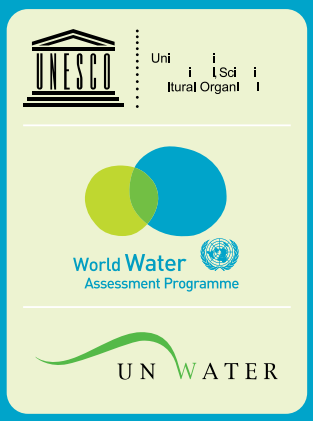


1 Summary

Water makes a critical contribution to all aspects of personal welfare and economic life. However, global water resources are coming under increasing pressure. It is widely recognized that over the next few decades global drivers such as climate change, population growth and improving living standards will increase pressure on the availability, quality and distribution of water resources. Managing the impacts of these drivers to maximize social and economic welfare will require intelligent policy and management responses at all levels of collection, production and distribution of water.

Economic policy-makers recognize that water has an importance for national economies which is largely unaccounted for. As a result, there is a growing interest in water accounting in parallel with broader environmental accounting. The initiatives of the United Nations (UN) System of Environmental-Economic Accounts for Water (SEEAW) and Eurostat are important in this context, as are the recent efforts of the Organisation for Economic Co-operation and Development (OECD). Another more recent initiative is that of the European Environment Agency (EEA).

This paper outlines key initiatives of these agencies to incorporate water-related indicators into wider systems of environmental accounting, as a step towards raising the profile of water's role in economic and environmental policy-making.

2 Lifting the veil of ignorance

Efforts to manage the impacts of drivers to maximize social and economic welfare will be thwarted unless we lift the veil of ignorance around all aspects of water status, management and use. Better data about water are not desired for their own sake, but for what they can do to improve decisions over a range of vital issues, including the following (see also WWAP, 2012, ch. 6):

- Determining the adequacy of **water for food production**. What is the current level of abstraction from surface water and groundwater? How much effluent returns to water courses for use elsewhere? How efficient is agriculture in its use of water? Can the growing needs of agriculture be met from existing sources?
- **Serving growing urban populations with water supplies**. How many urban residents are currently served from public supplies? What sources are used by the unserved population? What is average daily consumption by various groups? How much do people spend on water?
- Dealing with the **growing problem of wastewater collection and treatment**, especially in cities. How many households are connected to public sewers? How much of sewage collected is treated, to which standards? How much wastewater is released untreated?
- Estimating and coping with the **water footprint of major businesses**. What is the volume of water abstracted by business firms from their own, and from public, sources? How much is returned to water courses in a usable state? How efficient is industry in its use of water?
- Reducing the **vulnerability of populations to extreme events** such as droughts, floods and storms. How many people, and how much of the economy, is at risk from extreme events? What has been the impact of such events in the past on economic performance?
- Reducing the **impact of water abstraction and pollution on natural environments and ecosystems**. How severe is water pollution, in terms of

the concentration of pollutants in key water bodies? What are the trends in key 'marker' indicators such as fish populations and species? Is there a trend in aquifer levels? Are aquifers becoming more contaminated?

- Planning for the **impact of future climate change** on the above factors. Do time series of hydrological data indicate any trends likely to be caused by anthropomorphic climate change? What do climate models portend for a country's water future?

The difficulty of getting to grips with these problems is made worse by the lack of systematic data collection in most countries. This prevents regular reporting on water resources and water-use trends. Reliable and relevant information is crucial for guiding and monitoring policy-making and management.

Our context is the growing uncertainty about the future supply of water and its greater variability due to climatic factors. Previously, water planners and engineers had been able to base their decisions on characteristics of the water cycle and hydraulics which could be described within known statistical parameters and stable probability distributions. Today, however, these professionals have to deal with future probabilities of extreme events that have not yet been observed and are outside the known envelope of variability.

3 Data definitions and sources

Since it was first published in 2003, the United Nations *World Water Development Report* (WWDR) has included a comprehensive collection of data and indicators about the various dimensions of water resources and their uses (see, e.g., WWAP, 2012, ch. 6, 'From raw data to informed decisions'). The purpose of compiling these datasets is not just to obtain a snapshot in time, but to track trends and patterns in different dimensions of water and its uses over time, which falls within the mandate of the United Nations World Water Assessment Programme (WWAP) for monitoring and reporting on water around the world. The objective is to develop a set of indicators that is accepted across the entire UN system for monitoring performance, not only in the natural environment but also in the socio-economic and political environments of water, including governance, pricing and valuation. The main topics and associated indicators are shown in Annex 1 (and see WWAP, 2012, ch. 6 for a more in-depth discussion).

This aspiration is echoed at national and regional/local levels. Many countries want reliable and objective information about the state of water resources, their use and management to plan and safeguard their future water security. Farmers, urban planners, drinking water and wastewater service companies, the disaster management community, business, industry and environmentalists are all interested parties.

Internationally, a number of bodies are dedicated to improve the supply and quality of data related to water. These include the UN CEO Water Mandate Group (including the World Wildlife Fund), the Water Footprint Network, the Food and Agriculture Organization of the United Nations (FAO)'s AQUASTAT, the World Meteorological Organization (WMO)'s science platform, the Global Runoff Data Centre (GRDC), and WHO/UNICEF's Joint Monitoring Programme (JMP) for Water Supply and Sanitation.

There are also individual country initiatives. Australia, for example, has included a directive for developing water resource accounting as part of the National Water Initiative (launched in 2004).

But, as the WWDR4 makes clear, these approaches all depend on the presence of sufficient, comparable, timely and consistent raw data and processed information (WWAP, 2012, ch. 6). In reality, the data to populate the indicators are seldom systematically or reliably available, whether at the global, national, regional or basin level. Specifically:

- There is no agreed terminology. This leads to discrepancies in data definitions, compilation and analyses. The problem is wider than water. Terms such as 'green economy', 'sustainability', 'green growth', 'green jobs' and 'environment sector' are often used, but are not rigorous enough for the concepts, terms and definitions to be measured consistently across countries and over time (Cadogan-Cowper and Johnson, 2011).
- Data on the availability and quality of surface water and groundwater are poor and can be difficult to summarize because of the variable nature of the resource across different segments of time (seasonal, inter-annual, decadal) – hence the need to report on trends.
- The rate (quantity) of water abstraction is often estimated rather than measured. Estimates are subject to large uncertainties, particularly for water abstractions in agriculture.
- Trends are hard to establish, because historical datasets are rare or often discontinuous, and the dates of statistics are not always given.

It is likely that our knowledge of water resources and water use is getting worse due to the declining supply of data from national hydrological services (Figure 1).

As an example of the problems to be confronted, Total Actual Renewable Water Resources (TARWR), which is an important indicator, has not been systematically recorded and is not generally reflected in global water scarcity data – the underlying assumption being that hydrology is 'stationary'. But changing patterns of climate due to global warming have resulted in explicit recognition that the stationary hydrology assumption can no longer be maintained. The supply of data is particularly poor for groundwater and for water quality.

Data on water use tend to be more difficult to obtain than information on the state of water resources themselves. Yet these data are needed for assessing the productivity of water in terms of GDP per unit of water used to enable monitoring of the policy objective of 'decoupling' economic activity from resource use. Similarly, the efficiency of water use in different industrial processes should be monitored to determine the efficacy of water demand management programmes. In practice, this is often estimated using standard assumptions about water consumption

in specific industries. Without actual use data, improvements in water productivity cannot be tracked, and the impact of technological progress may be missed.

The same applies to the use of water in agriculture, which is also not normally measured directly. This is of concern, given the water intensity of agriculture relative to other sectors of the economy.

4 Constraints on better water monitoring and reporting

The WWDR4 notes that there are many institutional and political constraints that inhibit better monitoring and reporting of information on water resources and their use. Many water resources are shared between different political jurisdictions. The most obvious case is where river basins cross national borders. For instance, two-thirds of the surface water available to the Arab and Western Asia region comes from outside the region. Similarly, Latin America and the Caribbean has 61 large basins and an estimated 64 aquifers that cross national borders. 'Upstream' communities may be disinclined to share information about their water with 'downstream' users, where the division and sharing of the resource is a bone of contention. Private companies may withhold information on their water supply and use if they believe this is commercially sensitive.

Financial and technical constraints on data supply are also present. Measuring even the basic parameters such as flow can be very expensive. Remote sensing is an important and potentially cheaper resource, currently underused. Unfortunately monitoring water resources has a low priority and in any case remote sensing will never substitute for collecting local information.

5 International initiatives for valuing the environment in national accounting

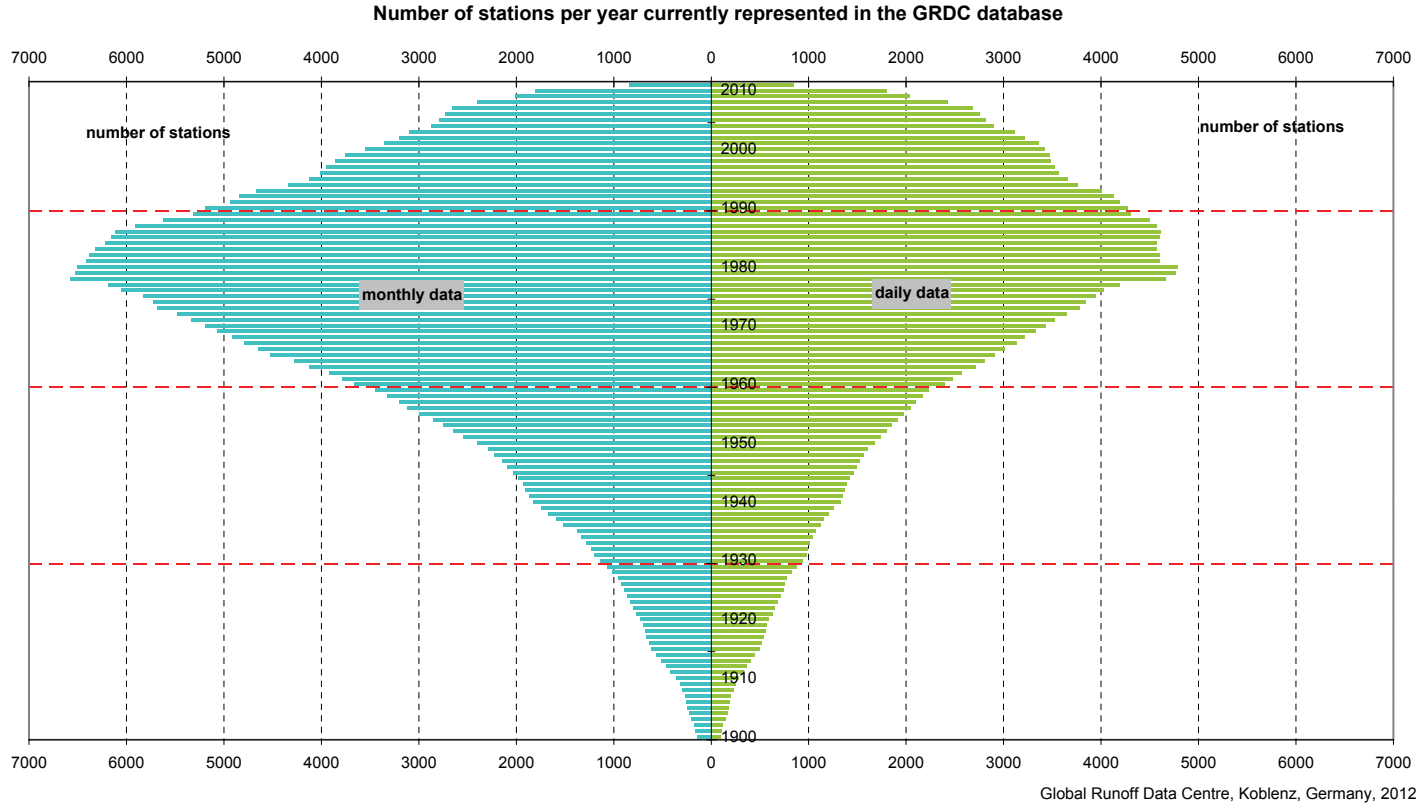
A number of international initiatives have been launched to promote the transition to a greener global economy. These include the UN *Green Economy Initiative*, the International Labour Organisation (ILO)'s *Green Jobs Initiative* and the OECD's *Green Growth Strategy*. The common aims of these initiatives are:

- Lower carbon emissions
- Increased use of clean, renewable resources of energy
- More efficient use of scarce (non-renewable) resources
- Reduced impact of production on ecosystems

Good information (a statistical database) is essential to meet these objectives. From a water standpoint, decision-makers need a revised, macro-level model of 'green accounting' that contains, among other things, basic data on:

- Water stocks and flows
- Water use by households, business and other sectors
- The value water provides in its various uses
- The costs incurred in developing, protecting and restoring water resources and services

Figure 1. Availability of historical discharge data in the GRDC database



Source: Global Runoff Data Centre (GRDC) in the Federal Institute of Hydrology, Koblenz, Germany, 2012. See http://grdc.bafg.de

• How these items affect the measurement and reporting of national economic performance

This is a model, in short, which links the state of environmental resources, including water, to economic and human social activity and which, ideally, gives rise to a key set of indicators that signal actions which result in progress towards a greener economy.

Despite recent initiatives (e.g. UN SEEAW), national accounts largely focus on a narrow view of economic performance and growth which relegates the environment, including water resources, to the status of an externality. This focus can entrench a misperception that water resources are infinite and that business as usual (which disregards the adverse impacts of water degradation and scarcity) is a viable option.

5.1 UNSD

The United Nations Statistical Commission (UNSC), which oversees the work of the United Nations Statistics Division, has adopted a conceptual framework for monitoring trends and the impact of economic and social development on the environment, namely, the System of Environmental Economic Accounts (SEEA). Within this overarching framework, a supplementary system has been devised specifically for water, SEEA-Water, launched in 2007. In 2010 this system was supplemented by the International Recommendations for Water Statistics (IRWS; see UNDESA-SD, 2012).

These are both compatible with, and enhancements to, the internationally used System of National Accounts (SNA), providing for data collection on natural, environmental water-related capital as a guide to the future sustainability of current economic and social activities and performance, as well as to water resource management needs. Ensuring a more equitable distribution of the benefits of water is seen as a crucial aspect of sustainability.

Although SEEA-Water and IRWS are relatively new, more than 50 countries are compiling or planning to compile water accounts. Improvements to SEEA-Water are ongoing (see WWAP-UNSD, 2011).

5.2 OECD

The OECD 2011 draft report on *Monitoring Progress Towards Green Growth* (OECD, 2011*a,b*) recommends a measurement framework and proposes a preliminary set of about twenty headline indicators based around four themes:

Environmental and resource productivity: The adoption of more resource- efficient and less polluting production technologies.

Natural asset base: A stocktaking of natural resources and ecosystem capital to measure whether they are being depleted, degraded or repaired over time. The natural asset base is crucial for the longer term sustainability of production, income and consumption.

Environmental quality of life: The direct impact of the environment on people's health and quality of life. This includes their exposure to air and water pollution and their access to environmental services and amenity.

Economic opportunities and policy responses: This includes economic opportunities provided by a greening economy, namely, production of environmental goods and services, research and development, green jobs and trade. It also includes

the monitoring of various 'enablers' such as appropriate price signals, incentives, regulation and management systems. Progress in this area has been bedevilled by disagreement on what constitutes 'environmental goods and services'. Existing classification frameworks for environmental protection cling to traditional activities rather than adapting to new production technologies and changing patterns of behaviour (WWAP-UNSD, 2011).

Overall, the OECD report is an important advance in statistical measurement, particularly for the purpose of international comparisons. Major problems in the quest for environmentally adjusted GDP do, however, remain. One of these is the monetary valuation of environmental costs, although in the case of natural resources, market information can enable adjustment for depletion.

5.3 UNEP

The United Nations Environment Programme (UNEP) *Green Economy Report* (GER) (UNEP, 2011) focuses on 11 economic sectors that are crucial to the transition to a green economy. These sectors are renewable energy, low-carbon transport, energy efficient buildings, clean technologies, improved waste management, improved freshwater provision, sustainable agriculture, forests and fisheries, investments in sustainable tourism practices, and resource efficient cities. In principle, the 11 economic sectors could be overlaid with the OECD's four environmental themes.

5.4 Eurostat

Eurostat's *Handbook on the Environmental Goods and Service Sector* is the main reference for statistical measurement and is to be incorporated into the updated SEEA. It defines the environmental goods and services sector as producers of technologies, goods and services that (Eurostat, 2009, p. 29):

Measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes 'cleaner' technologies, goods and services that prevent or minimise pollution.

and which

Measure, control, restore, prevent minimise, research and sensitise resource depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources.

The aim of environmental protection is to avoid or minimize the impact of economic activity on the environment; for example, by the reduction or elimination of air emissions, or the reduction or treatment of waste and wastewater. Resource management expenditures aim to reduce the extraction of natural resources, promote re-use and recycling, and enhance the replenishment and general management of natural resources.

While much of the data available on the use of resources and amount of emissions relates to industry – the producers of goods and services – it is also possible to model selected natural resources (such as energy and water) and emissions embodied in final consumption goods and services, capital goods, and imports and exports.

5.5 Incorporating ecosystem accounts into the SEEA

Environmental accounts in physical units supplement conventional national accounts by providing data on the use and availability of natural resources. They attempt to measure the overall efficiency of the economy in terms of the input of material or energy resources and the waste generation necessary to produce a unit of GDP. A second aim is to assess the depletion of resources. Physical constraints can be inserted into macroeconomic analysis to inform the quest for greener growth. For this to succeed, a common unit-equivalent needs to be found.

Quality changes can be valued in monetary terms, but currently this mainly applies to items used in productive economic processes. The emphasis on 'productive' inputs sidelines or relegates to the status of an externality pure public goods, and does not do justice to resources with complex ecosystem interactions. For this reason, the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA) decided in its session of June 2011 to devote Volume 2 of the new SEEA to ecosystem accounts. The EEA, Eurostat and the World Bank have been asked to assist with this work (Weber, 2011).

5.6 EEA ecosystem capital accounts

The EEA has also been developing ecosystem accounts. The EEA project explores the feasibility of framing ecosystem accounts and identifying operational indicators and aggregates which can be delivered, and how they could be integrated into enlarged national accounts.

In the EEA system, ecosystems are described as a stock which deliver a bundle of services, some of which are appropriated, incorporated into products, and accumulated and/or consumed by private operators. Other services comprise public goods benefiting the economy and human well-being. Ecosystem capital accounts enable an assessment to be made of the sustainability of the economy–ecosystem interaction from the standpoint of nature; they measure the state of ecosystems and – when degradation is observed – calculate the costs necessary to avoid, repair or compensate it. This is a measure of ecosystem capital depreciation or 'consumption'. At the same time, it delivers a measure of physical constraints on future economic production.

6 The WWAP perspective

WWAP has a vital interest in improving information about water for the use of national governments, international agencies, and all those facing the consequences of water stress, including households, farmers, businesses and champions of the natural environment.

To this end, a WWAP-led Task Force on Indicators, Monitoring and Reporting (UNTF-IMR)[1] was established within UN-Water (an authoritative UN body comprising 29 agencies working on different aspects of freshwater) in 2008 to contribute to public information and informed decision-making in the water and related sectors, including sanitation, at global and national levels, through improved monitoring and reporting. In particular, the UNTF-IMR aimed to support international and national decision-makers and advance the implementation of internationally agreed-upon goals and targets on water and sanitation.

Furthermore, to support WWAP and the work of the UNTF-IMR, WWAP established in 2008 an Expert Group on Indicators, Monitoring and Databases (EG-IMD)[2] to identify the key dimensions and indicators of water resources and their management as well as the work required to be able to produce such indicators on an ongoing basis. After a structured review of the issues, the conclusion reached was that, given the many different interests of decision-makers and managers, the principal challenge in the field of monitoring water resources at global, regional and national levels is not the identification of a set of key indicators for water resources and their management, but is rather the systematic generation of a set of core data items that will allow a wide range of such indicators to be calculated to meet the many different needs of the potential audiences.

Annex 1 is a summary from table 6.1 in the WWDR4 listing critical indicators under the Drivers-Pressures-State-Impact-Response framework grouped by topics to analyse problems and options for water in its various forms. Progress in improving data for a critical mass of these indicators would be welcome to WWAP and its stakeholders.

As this paper has shown, current efforts to improve water information systems are driven by different agencies with their own missions and trajectories. Improved basic data can, however, serve various purposes, and can be the common building blocks for a range of indicators. SEEA-Water describes this as 'integrating statistics to allow for multiple purposes and multiple scales of analysis' (UNSD, 2012, p. 2). The WWDR4 expresses the same point in these terms: 'Global programmes such as WWAP need to focus on core data items from which different users can calculate indicators of specific interest to them' (WWAP, 2012, p. 158).

1 For more details on the work of the UNTF-IMR, see http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/indicators/un-water-tf-on-imr/

2 For more details on the work of the WWAP EG-IMD, see http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/indicators/wwap-eg-on-indicators/

7 Concluding messages

At the heart of the Green Economy is the sustainable use of natural resources as both a source of materials and energy and a sink for waste. Water stress is arising from rapid and uncontrolled exploitation for both purposes.

Better information about water is needed by national governments, who are concerned about the state of their water resources and the way they are being used, and by international organizations such as the OECD, European Union, the African Union and the G8, who are raising regional and global concerns on this matter.

WWAP, in its WWDRs, has been reporting on a core set of indicators (see Annex 1) to throw light on these key problems, among others. These indicators and others rely on data collected by national governments. Progress made in identifying relevant indicators still leaves the task of collecting and analysing raw data, and in many countries, this is where the bottleneck lies.

Progress continues in various forums (e.g. UN SEEAW, the EEA and various national governments) with the aim of producing coherent and comprehensive systems incorporating water and other environmental data into national incomes. These initiatives are welcome, and should be supported.

Pursuit of the Best should not be allowed to be the enemy of the Good, and it is important for urgent progress to be made also on the collection of the basic data for the WWDR indicators, which are the building blocks for the larger and more ambitious accounting systems, and the essential support for the urgent policy issues outlined above.

Annex 1 United Nations *World Water Development Report* indicators

Topic	Indicator
Level of stress on the resource	Index of non-sustainable water use
	Rural and urban population
	Relative water stress index
	Sources of contemporary nitrogen loading
	Impact of sediment trapping by large dams and reservoirs
	Coefficient of variation for the climate moisture index
	Water re-use index
Governance	Access to information, participation and justice
	Assessing progress towards achieving the integrated water resources management (IWRM) target

Topic	Indicator
Settlements	Percentage of urban population
	Proportion of urban population living in slums
State of the resource	Total actual renewable water resources
	Total actual renewable water resources per capita
	Inflow from other countries as share of total actual renewable water resources (Dependency Ratio)
	Proportion of total actual renewable freshwater resources withdrawn: MDG Water Indicator
	Groundwater development stress
	Brackish/saline groundwater at shallow and intermediate depths
Ecosystems	Fragmentation and flow regulation of rivers: dam Intensity
	Dissolved nitrogen (nitrates + nitrogen dioxide)
	Trends in catchment protection
	Freshwater species population trends index
Health	Disability-adjusted life year
	Prevalence of stunting among children under age 5
	Mortality rate of children under age 5
	Access to improved drinking water
	Access to improved sanitation
Food, agriculture and rural livelihoods	Percentage of undernourished people
	Percentage of poor people living in rural areas
	Agriculture GDP as share of total GDP
	Irrigated land as a percentage of cultivated land
	Agriculture water withdrawals as share of total water withdrawals
	Extent of land salinized by irrigation
	Groundwater use as share of total irrigation
Industry and energy	Trends in industrial water use
	Water use by major sector
	Organic pollution emissions (biochemical oxygen demand) by industrial sector
	Trends in ISO 14001 certification
	Electricity generation by energy source
	Total primary energy supply by source
	Carbon intensity of electricity generation
	Volume of desalinated water produced
	Access to electricity
	Capability for hydropower generation
Risk assessment	Mortality risk index
	Risk and policy assessment indicator
	Climate vulnerability index
Valuing and charging for the resource	Water sector share in total public spending
	Ratio of actual to desired level of public investment in drinking water supply
	Ratio of actual to desired level of public investment in basic sanitation
	Rate of operation and maintenance cost recovery for water supply and sanitation
	Water and sanitation charges as percentage of various household income groups
Knowledge base and capacity	Knowledge index

Note: An Indicator Profile sheet with a detailed definition and explanation of how the indicator is computed (as well as data tables for some indicators) is available for most indicators at http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/indicators/. Exceptions are sub-indicators for 'Total actual renewable water resources'.

Source: WWAP (2012, table 6.1, pp. 160–61).

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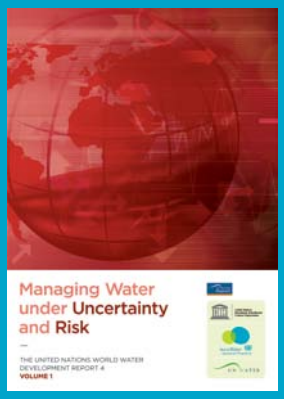
The United Nations World Water Development Report 4

The United Nations World Water Assessment Programme (WWAP) is hosted by UNESCO and brings together the work of 28 UN Water members and partners in the triennial *World Water Development Report* (WWDR).

This flagship report is a comprehensive review that gives an overall picture of the world s freshwater resources. It analyses pressures from decisions that drive demand for water and affect its availability. It offers tools and response options to help leaders in government, the private sector and civil society address current and future challenges. It suggests ways in which institutions can be reformed and their behaviour modified, and explores possible sources of financing for the urgently needed investment in water.

The WWDR4 is a milestone within the WWDR series, reporting directly on regions and highlighting hotspots, and it has been mainstreamed for gender equality. It introduces a thematic approach Managing Water under Uncertainty and Risk in the context of a world which is changing faster than ever in often unforeseeable ways, with increasing uncertainties and risks. It highlights that historical experience will no longer be sufficient to approximate the relationship between the quantities of available water and shifting future demands.

The WWDR4 also seeks to show that water has a central role in all aspects of economic development and social welfare, and that concerted action via a collective approach of the water using sectors is needed to ensure water s many benefits are maximized and shared equitably and that water related development goals are achieved.



Monitoring Framework for Water The System of Environmental-Economic Accounts for Water (SEEA Water) and the International Recommendations for Water Statistics (IRWS)

The UN World Water Development Report (WWDR) series has reiterated the fact that data and information on water resources are incomplete or lacking altogether for some countries. It is against this backdrop that the UN World Water Assessment Programme (WWAP) reached out to the United Nations Statistics Division (UNSD) to produce this briefing note together and provide a better understanding of international methodological standards for water which have been developed by the international statistical community. This briefing note will help water professionals step outside the water box and take into account broader social, political and economic issues affecting the use and allocation of water resources.

UNESCO

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