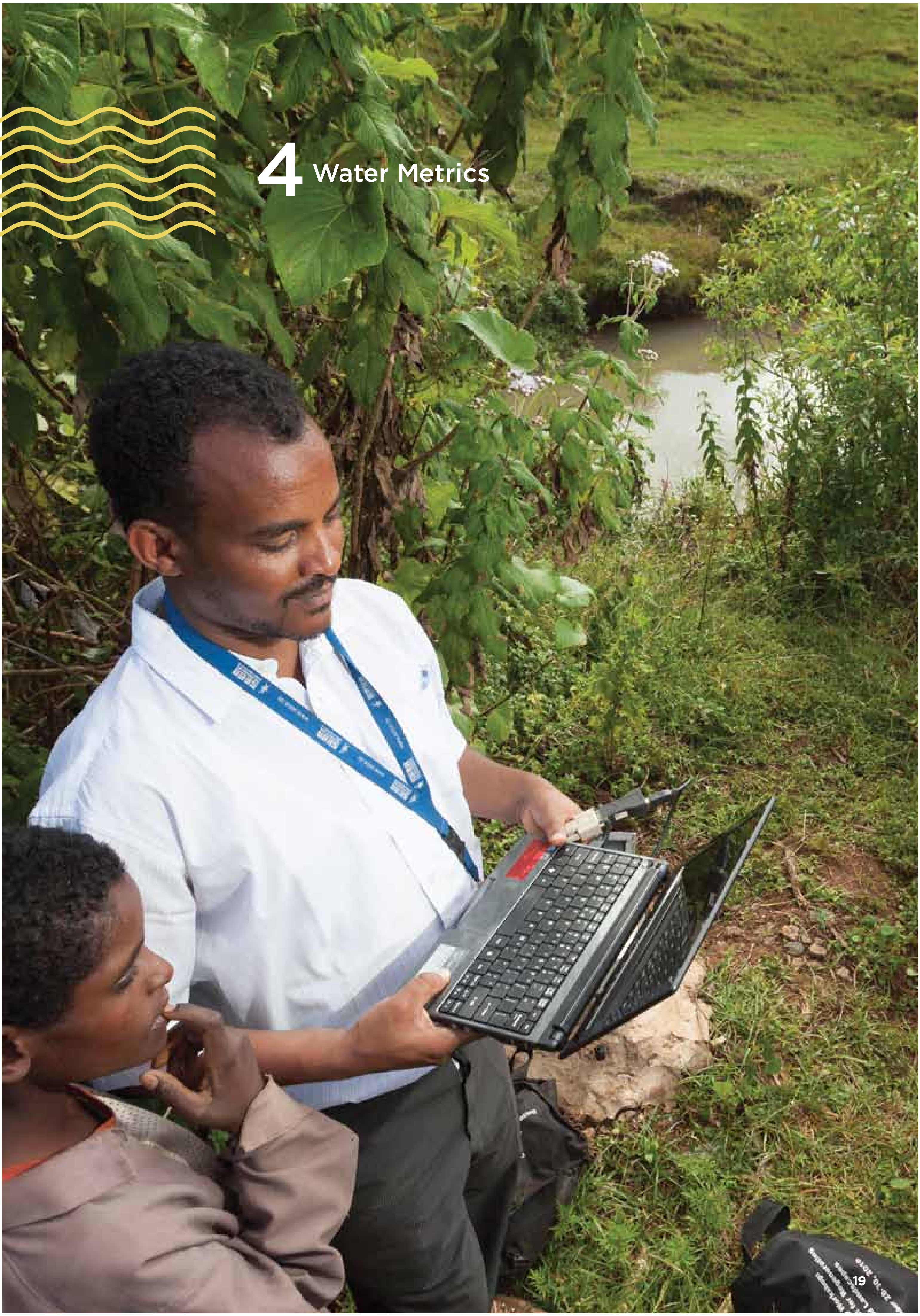
4 Water Metrics



4 Water Metrics

Lead author: Lisa-Maria Rebelo, Jean-Marc Faurès (FAO), Poolad Karimi (UNESCO-IHE), Wim Bastiaanssen (UNESCO-IHE Institute for Water Education)
With contributions from: Meredith Giordano, Vladimir Smakhtin, Peter McCornick

SETTING, MEASURING AND MANAGING SUSTAINABLE DEVELOPMENT WATER TARGETS

Society has a universal need for water that crosses all sectors of activity. We need to be able to measure progress towards sustainable water for all by working towards targets that consider the different dimensions of water resources and use, including water quantity and quality.

A suite of indicators that reflect water use by different sectors is needed to measure progress towards the forthcoming SDGs' water-related targets. Such indicators will need to rely on national data, must consider the variation in data availability and can be complemented with new cost-effective ways for data collection.

Remote sensing measurements, smart field sensors, ICT technologies and open access databases create new opportunities to more accurately, cost-effectively and transparently quantify water resources. However, the usefulness and relevance of any indicators will be as important as the ease of measurement.

The challenge in progressing towards the water-related targets is to ensure that a balance is achieved between the competing uses of water, meeting human needs while maintaining ecosystem health.

SUITE OF INDICATORS NEEDED TO MONITOR PROGRESS

Indicators are needed at the national scale to allow comparisons between countries, to monitor progress and to aggregate at the global scale. The use of specific indicators, such as water use efficiency or water productivity, can mask the complexity and trade-offs required to achieve the respective development outcomes. It is not feasible to express the use of water in complex river basins with just a handful of indicators.

A suite of indicators, rather than a single indicator such as water productivity, should be used for monitoring the progress towards the water SDG for *all* users, while also maintaining healthy ecosystems. These need to be designed to reflect the variety of water situations within a country.

MAKING MORE EFFICIENT USE OF WATER—IMPROVING WATER PRODUCTIVITY

Improving water-use efficiency across all sectors is proposed as a global target, reflecting current and likely future constraints on our water resources.

> **Water Use Efficiency vs. Water Productivity:** Water use efficiency (WUE) is used primarily by agronomists and breeders and depicts the output/unit of transpiration or evapotranspiration at the field scale (kg/m^3). In the SDGs, WUE is also promoted as a goal for other sectors. Water productivity (WP) evolved from WUE and measures how systems convert water into goods, services or nutrition, in other words, production (in physical quantity or economic value)/water used. WP offers a broader concept and opportunities for analysis at larger scales.
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> **Agricultural Water Productivity:** Agriculture is the number one user of water (70–90%). The world relies on irrigation, with 20% of the land producing 40% of the food. Agricultural water productivity is the ratio of the net benefits from crop, livestock and mixed agricultural systems to the amount of water used to produce those benefits. The objective is to produce more food, income, livelihood and ecological benefits at less social and environmental cost per unit of product or service. The denominator of the water productivity equation is expressed in terms of either water supply or water depletion. Water is depleted when it is evaporated, incorporated into a product, flows to a location where it cannot be readily reused or becomes heavily polluted. Globally, the amount of water needed to produce goods and services from agriculture directly depends on gains in water productivity: the higher the productivity, the less pressure on the resources and the ecosystems.

In conditions of water scarcity, and in particular when all the water in a river basin is allocated to different users, any change in water use will result in winners and losers. Increasing agricultural water productivity in upstream reaches of river basins through better rainfall capture and more check dams reduces downstream flows supporting other farmers, fishers, household users and wetlands. Producing more food often means putting more water into irrigation and taking it out of other uses. Water productivity analysis at a basin scale can highlight these trade-offs to help decision makers develop strategies where the benefits exceed the costs and where both are clearly assessed and quantified.

Achieving water productivity is further complicated by factors outside the water sector, such as changing prices for agricultural commodities, increasing demand for biofuels, urbanization and changing diets with rising incomes. Policies influencing such factors will also influence water use and thereby influence the scope for gains in water productivity.

> ***Good water accounting is needed to identify the major water-related processes and understand better which water resources are available and exploitable for a river basin and its tributaries.***

NEW WATER ACCOUNTING TOOLS—OPPORTUNITIES FOR BASIN-SCALE MONITORING

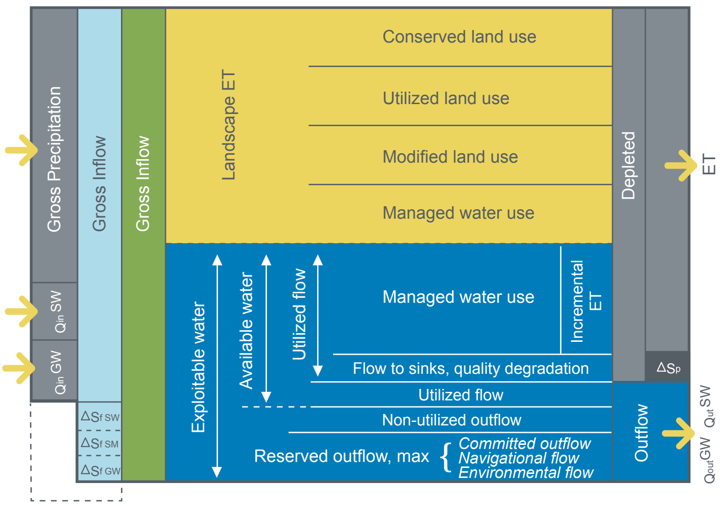
Water productivity is an indicator of the efficient use of water; *water accounting* is a monitoring tool. We pay specific attention here to water accounting and productivity, as recent science has contributed to new opportunities to make use of these concepts in the context of the SDGs.

Good water accounting is needed to identify the major water-related processes and understand better which water resources are available and exploitable for a river basin and its tributaries. Water accounting is a water resources assessment report given at regular time intervals (months, seasons, years). It is a framework, rather than a number of indicators, and provides a more balanced view of water supply and demand and groundwater conditions. Quantified water accounts can be used to set management targets and subsequently monitor these targets. Examples of water accounting frameworks are the System for Environmental-Economic Accounting for Water, the IWMI's Water Accounting (WA) and Water Accounting Plus (WA+) and the Water accounting and auditing guidelines of the Food and Agriculture Organization (FAO); these provide principles and approaches to assist water institutions with implementing and increasing the effectiveness of investments.

New Insights in Water Accounting

Several organizations, including FAO, United Nations Educational, Scientific and Cultural Organization - Institute for Water Education (UNESCO-IHE) and IWMI are working towards better and more effective monitoring of water. Water Accounting Plus (WA+), developed by IWMI and partners, explores the wealth of global open access data and the development of an international standard to express complex water management issues. WA+ uses satellite-derived estimates of land use, rainfall, evaporation, transpiration, interception, water levels of open water bodies, biomass production, crop yield and measured basin outflow to produce a low-cost and reliable water account. These data are supplemented with the outputs of global hydrological models that provide access to explicit data on surface water networks and aquifers. These data inputs allow calculation of explicit water flows by different land use types, water consumption by the natural landscape and net water withdrawal processes in complex river basins. A data repository (www.wateraccounting.org) is being developed that presents the data in different sheets, allowing easy and quick access to particular topics, such as agricultural production, ecosystem services, useable flows and groundwater depletion. A complex river basin is thus expressed in simple sheets that policy makers, lawyers, economists, agronomists and environmentalists understand. Remote sensing data, FAO's AQUASTAT data and GlobWat model provide input to the WA+ sheets.

FIGURE 1. **Schematic presentation of the resource base sheet (Water Accounting+)**



Source: *Karimi, Poolad; Bastiaanssen, W. G. M.; Molden, D. 2013. Water accounting plus (WA+) – a water accounting procedure for complex river basins based on satellite measurements. Hydrology and Earth System Sciences, 17(7):2459-2472*

Specific indicators, such as water use efficiency or water productivity, can mask the complexity and trade-offs required to achieve development outcomes.

NEW METHODS AND TECHNOLOGIES

Any effort towards establishing water-related targets as part of the SDG process will require substantial efforts to establish a monitoring capability that can provide quality, policy-relevant information. Today, water monitoring is well below the levels needed to measure progress. Many countries have let their water monitoring networks decline for decades due to underfunding and low priorities. There are only scattered examples of water quality monitoring, and few countries have adopted sound and conceptually valid water accounting mechanisms. The global synthesis of water data performed by FAO's AQUASTAT information system will continue to operate, but it relies mostly on countries that can only offer scattered, incomplete or outdated information. Radical changes are needed alongside increased funding to improve spatial and temporal coverage of existing datasets and incorporate data requirements of new indicators.

At the same time, it is now possible to take advantage of the low-cost opportunities to tap into the vast quantities of data collected through remote sensing and near sensing and to collect and disseminate data through mobile technologies. Satellites measure the actual land surface conditions with very advanced instruments, and the accuracies attainable are frequently of similar quality as those of a routine handheld device or buried sensor in the soil. Moreover, the data are available to everyone. Such solutions will help to cost-effectively develop baselines, strengthen national reporting systems and monitor progress towards achieving the SDGs. For example, remote sensing data from the last 30 years can be used to thoroughly study changes in water, land and ecosystems. Advances in technology have helped experts use satellites to measure crop water consumption, crop production and soil water status and water levels in reservoirs.

One of the main challenges in developing these new sources of information will be to ensure their ownership and full integration within the national water monitoring and reporting mechanisms.