Freshwater resources

Freshwater resources, whose distribution varies widely among and within countries, are of major environmental and economic importance. Various forces exert pressure on water resources. These include over-abstraction and degradation due to pollution loads from human activities (agriculture, industry, households), changes in climate and weather conditions, and the introduction of invasive species. Over-abstraction of water, in particular, can have significant environmental and socio-economic consequences. These range from low river flows, depleted groundwater and degraded water quality (including salinisation of freshwater bodies in coastal areas), to loss of wetlands, desertification and risks for both food security and economic production.

The main challenges are to ensure sustainable management of water resources, avoiding over-abstraction and degradation. This management model aims to maintain adequate supplies of freshwater of suitable quality for economic activities and human use, and to support aquatic and other ecosystems. To that end, risks related to water quantity and quality must be identified, targeted and mitigated in a coordinated manner.

Water quantity is best managed through a combination of water demand management, water-efficient practices and technologies, and well-designed water allocation. Water quality management requires prevention, reduction and management of water pollution. It must cover all sources (diffuse and point sources) and all water bodies (surface, ground, coastal). Further, it must consider all major existing and emerging pollutants.

Infrastructure and other investments can also affect the natural integrity of rivers, lakes, aquifers and wetlands. In addition, they can influence hydromorphological conditions, the natural water retention capacity of the basins and ecosystem function. Both polluters and users should be kept accountable as much as possible.

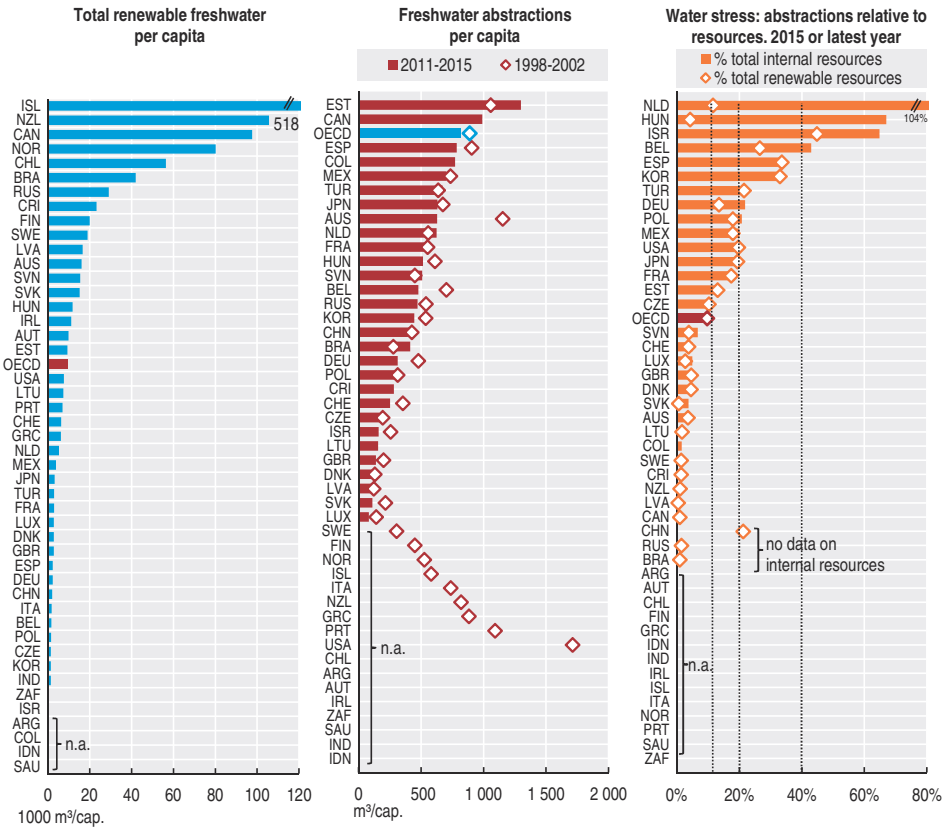
This chapter focuses on water quantity issues and on renewable resources.

Main trends and recent developments

Countries' endowment in freshwater resources varies greatly and local water scarcity remains of concern

The availability of renewable fresh water resources and the levels of water stress – intensity of use of available renewable resources – show wide variation among and within countries (Figures 8.1a and 8.1c). Most OECD countries face at least seasonal or local water quantity problems. Several have extensive arid or semi-arid regions where scarce water constrains economic development. In more than one-third of the OECD, freshwater resources are under moderate to medium-high stress. In a few countries, water resources are abundant and population density is low. In some countries such as Saudi Arabia, renewable freshwater resources are limited. In these cases, public water supply has to rely

Figure 8.1. **Freshwater endowments and abstraction intensities**

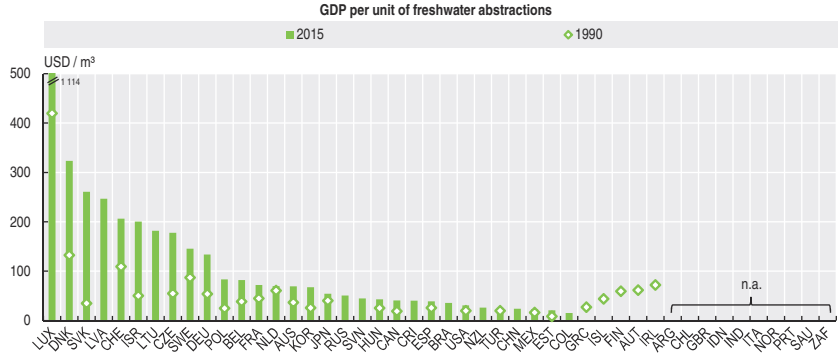


Note: In panel C (water stress): < 10%: low; 10-20%: moderate; 20-40%: medium-high; > 40%: high. United Kingdom (GBR) refers to England and Wales only.

Source: OECD (2017a, 2017b) *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933484688

Figure 8.2. **Freshwater abstraction has decoupled from economic growth in many countries**



Source: OECD (2017b), "Water: Freshwater abstractions", *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933484698

on other sources of water (e.g. desalinated sea water). Agriculture in these countries mainly depends on non-renewable groundwater.

Freshwater abstraction is stabilising

Over the 1970s, agricultural and energy sectors in most OECD countries had increased demand for water. Consequently, countries increased water abstraction. In the 1980s, some

countries stabilised their abstractions. They adopted more efficient irrigation techniques, reduced water-intensive industries (e.g. mining, steel), increased the use of more efficient technologies and reduced losses in pipe networks.

Since the late 1990s, trends in freshwater abstractions have been generally stable (Figure 8.1b). In some countries this is due to increased use of alternative water sources, including water reuse and desalination.

Abstraction for agricultural uses is decreasing in OECD countries, largely due to improved irrigation

Agricultural water abstraction has decreased in most OECD countries since 2005. This confirms the trend in place since the early 2000s, particularly in countries where agriculture relies largely on irrigation. Some countries achieved major policy reforms in agricultural and water regulations, or introduced energy tariffs for groundwater pumping. Farmers had to adapt both to the new policies and a changing climate. Due to the large weight of agriculture in total water use, reductions in agricultural water abstraction contribute to mitigating water stress in a majority of OECD countries (OECD, 2016).

Freshwater abstraction has decoupled from economic growth in many OECD countries

In all countries for which data are available, national income generated per unit of freshwater abstracted increased in the last two decades (Figure 8.2). The greatest gains occurred in the Slovak Republic, Israel, Poland and the Czech Republic, where productivity levels more than tripled during the period. In Israel, the performance essentially derives from three factors. These include extensive reuse of treated wastewater and pioneering investment in water-efficient technologies (e.g. drip irrigation). And pricing reflects the resource cost, thus shifting towards higher-value water uses. In Central European countries, water productivity gains likely result from improved infrastructure (less leakage) and structural changes in the economy (towards less water-intensive industries).

Robust water allocation can strengthen incentives for innovation in water-intensive activities. Abstraction charges tend to be low in most countries. Therefore, increasing these charges would improve cost recovery. They would also provide a price signal, making low-value and inefficient water uses less attractive. Tradable water permits or abstraction rights exist through either formal or informal water markets. These have been shown to encourage allocating water towards higher-value uses. But safeguards are needed to avoid potentially negative impacts of such trading such as diversion of environmental flows, speculative behaviour from investors who do not reside in the basin, or distributional issues when well-off groups or users “buy and dry” poor ones. Further, transaction costs should be kept as low as possible, whatever the regime in place (OECD, 2015).

Measurability and interpretation

The indicators presented in this chapter give insights into quantitative aspects of water resources. They relate to the following:

- Available **renewable freshwater resource stocks** expressed as the long term annual average availability in cubic metres per capita.
- Total **freshwater abstraction** per capita.

- The **intensity of freshwater resource use** (or water stress), expressed as gross abstraction from groundwater and surface water bodies in percentage of total available renewable freshwater resources (including transboundary inflows) and percentage of internal freshwater resources (precipitation minus evapotranspiration). See also *Glossary*.

These indicators are complemented by the following:

- **Freshwater abstraction in relation to gross domestic product** expressed as gross domestic product per cubic metre of abstracted water, as a proxy for water use productivity.

National-level indicators as shown here may hide significant territorial and seasonal differences. They should be complemented with information at the sub-national (river basin) level. They should also be read in connection with indicators on water quality. Finally, water can affect economic growth through risks of floods and droughts, which are not covered here.

Water resource accounts and water statistics provide information on freshwater resources. These are available for most OECD countries. However, definitions and estimation methods may vary considerably by country and over time. More work is needed to improve the completeness and historical consistency of data on water abstraction and the methods for estimating renewable water resources. Better data on freshwater stored in artificial reservoirs and in underground formations would allow a more complete assessment of water stress. Data on rain water harvesting would be equally useful. As well, more is needed to mobilise data that adequately reflect the spatial distribution of water stress.

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