

# Groundwater use

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Groundwater use in Africa

Please cite page as: Africa Groundwater Atlas. 2019. Groundwater use in Africa. British Geological Survey. Accessed [date you accessed the information]. Weblink.

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## What is groundwater in Africa used for?

Groundwater is the main source of water for drinking, cooking and sanitation for most people in Africa, especially in the dry season - for both rural and much of urban populations. Most groundwater is abstracted directly by users from low yielding, relatively shallow (usually less than 50 m deep) boreholes or hand dug wells, usually with hand pumps. Deeper, higher yielding boreholes are less common, but are used in many urban areas to provide piped municipal water supplies, usually with electric (increasingly solar powered) or hydrocarbon pumps.



Evidence suggests there is growing use of groundwater to support economic livelihood activities in Africa - particularly for irrigated agriculture and for industry. Most of this is likely to be at a small scale - by individuals or communities, such as to support market garden irrigation or local food or drink businesses.

However, it is very difficult to estimate how much groundwater is being used in Africa, and for what purposes. This page gives information on some of the main sources of available information.

## **Estimating groundwater use**

There are many attempts to estimate how much groundwater is used in Africa, at local, national and international scales - and also to estimate how many people depend on groundwater, and the kinds of activities that groundwater supports. These estimates are difficult, and there is much variation between different estimates. This is mainly because groundwater use is highly dispersed, both from improved (e.g. community boreholes) and unimproved (e.g. springs or hand dug wells) sources. It is therefore very difficult to directly measure how much groundwater is abstracted and used, and for which purposes. Even if data are collected, there are often problems in recording, managing and accessing the data. Nevertheless, these estimates are very useful, not only in trying to quantify demand in order to better balance against groundwater resources and therefore support groundwater development, but also in highlighting the value of groundwater.

There are two main sources that provide quantitative data on groundwater use globally, including in Africa: the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP) and the UN Food and Agriculture Organisation (FAO)'s AQUASTAT database. Each of these has a focus

on water for different uses: FAO AQUASTAT for agricultural use (although it includes information on municipal (piped/tap) water supplies and industrial water supplies; and the JMP for drinking water use. A summary of these two data sources, and some others, is below:

## [FAO AQUASTAT](#)

[FAO AQUASTAT](#) is the UN Food and Agriculture Organisation's (FAO) global water information system on water and agriculture. Its main focus is on irrigation and agricultural water use. It does not include any data on distributed private domestic water use.



The screenshot shows the FAO AQUASTAT website homepage. At the top, there is a blue header with the FAO logo and the text 'Food and Agriculture Organization of the United Nations'. To the right of the logo is a search bar with the text 'Google Custom Search' and a magnifying glass icon. Below the header, there are navigation links: 'About FAO | In Action | Countries | Themes | Media | Publications | Statistics | Partnerships'. Below this, there are language options: 'العربية | 中文 | English | Français | Русский | Español'. The main heading is 'AQUASTAT - FAO's Global Information System on Water and Agriculture'. Below the heading is a navigation menu with tabs: 'Overview', 'Databases', 'Geospatial Information', 'Profiles', 'Data Analysis', 'Activities', and 'Publications'. The 'Overview' tab is selected. On the left side, there is a sidebar menu with items: 'History', 'Challenges', 'AQUASTAT methodology', 'Water resources', 'Water use', 'Irrigation and drainage', 'Institutional framework', and 'Wastewater'. The 'AQUASTAT methodology' item is highlighted. To the right of the sidebar menu is a large image showing a person's hands pointing at a map on a screen. Below the image is the heading 'The AQUASTAT methodology' and a paragraph of text: 'For acquiring reliable data and information, the importance of cooperating with national resource persons working in the field of water and agriculture, with good networking capabilities and a sense of responsibility, has been shown to be vital since AQUASTAT was created. Experience and lessons learned in global water information management show the importance of national capacities on which the SDG process is drawing.'

AQUASTAT includes profiles for each country, which contain general information on the geographical and economic situation of the country, and more detailed information on surface water and groundwater resources, water use, and water management. It provides information on the coverage of selected services, and also data on actual volumes of water use for different purposes.

The AQUASTAT Main Database reports water statistics at a country level. It collates data that has been collected and reported by various national and international agencies, but mostly from national government statistics offices and water and agricultural authorities. AQUASTAT collates this information by annual questionnaires sent to national correspondents in each country.

AQUASTAT is based on the best available data and analysis techniques, but how comprehensive and accurate it is depends on the data collected and reported by third parties. There are a number of data gaps for many countries, and these gaps are often worse for groundwater than for surface water, because groundwater use is more difficult to measure directly than surface water use. AQUASTAT uses [modelling](#) to fill in some of these data gaps. It should be recognised that these modelled data may not be accurate.

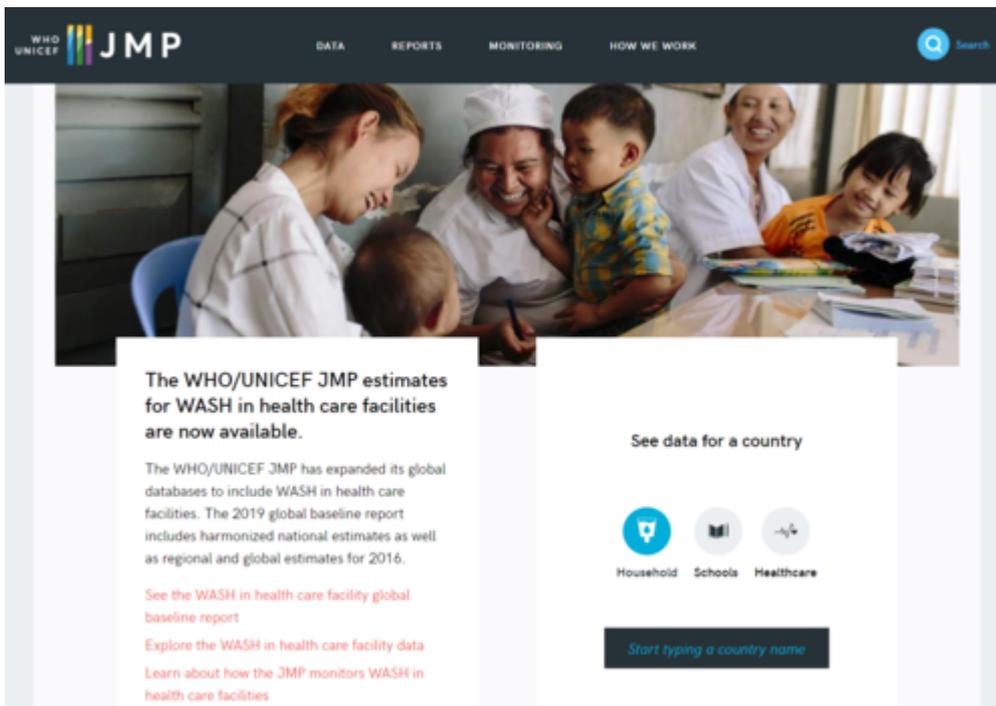
You can see some of the FAO AQUASTAT groundwater and other water statistics on the Atlas country pages. These statistics provide a very useful overview of the extent of groundwater resources and use in each country. They allow us to compare between countries, and between groundwater and surface water resources. However, these statistics are not comprehensive: in part because there are significant gaps in available data on groundwater use in many countries; and in part because AQUASTAT largely does not include data on private domestic water use - which is the

main use of groundwater in most African countries.

More information and background about FAO AQUASTAT, including explanations of the AQUASTAT statistics that are used in this Atlas, are on this [FAO AQUASTAT information page](#).

## **[JMP](#) - WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation**

The [WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation](#) works to monitor progress towards the Sustainable Development Goals (SDGs). It focuses on drinking water, and does not include any data on agricultural (including irrigation) or industrial water use.



The WHO/UNICEF JMP estimates for WASH in health care facilities are now available.

The WHO/UNICEF JMP has expanded its global databases to include WASH in health care facilities. The 2019 global baseline report includes harmonized national estimates as well as regional and global estimates for 2016.

[See the WASH in health care facility global baseline report](#)

[Explore the WASH in health care facility data](#)

[Learn about how the JMP monitors WASH in health care facilities](#)

See data for a country

Household Schools Healthcare

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Most of the JMP data on water supply and sanitation coverage come from national household surveys and censuses, carried out by government agencies in each country, often with support from international agencies. There is therefore some consistency between the datasets from each country, but also some differences.

The JMP provides summary statistics for each country on the coverage by water supply and sanitation at a household level, and also for schools and healthcare facilities. It does not include data on actual volumes of water used. It includes data on the percentage coverage of different classes of water sources that provide the **primary source of drinking water** for each facility (household, school or healthcare facility). This doesn't generally include water used for other domestic purposes (e.g. cooking and washing). The summary data identifies different water source types according to whether they are improved (basic, limited or safely managed); unimproved; or surface water sources. The improved water source category includes specifically groundwater sources (e.g. boreholes/tubewells, protected dug wells or springs); but also piped or tap water, and packaged (bottled or sachet) water - both of which can include both surface and groundwater. The JMP website also provides country files with more detailed information, which subdivide the data on improved water sources, to show the coverage by different kinds of groundwater sources -

borehole/tubewells, protected and unprotected dug wells or springs.

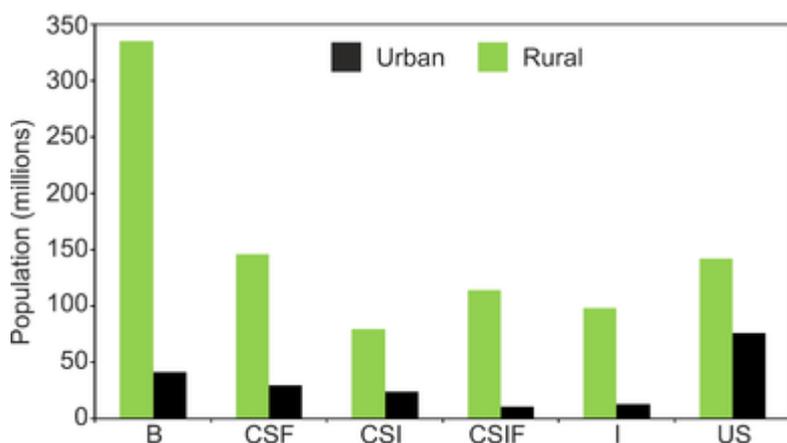
Because the JMP data do not distinguish the sources of piped/tap water, or packaged water - both of which can come from groundwater - the data are a minimum estimate of the extent of groundwater use for drinking water.

## Other sources of information on groundwater use

### Groundwater use for irrigation

[Seibert et al. \(2010\)](#) provide an estimate of the amount of groundwater used for irrigation around the world, including in Africa, based on the FAO AQUASTAT statistics. It is worth bearing in mind that these figures are likely to be underestimates for Africa, because much groundwater use for irrigation is on a small scale and is probably largely unrecorded.

### An estimate of groundwater dependency in rural Africa using population data



Urban and rural population living on: basement rocks (B); consolidated sedimentary rocks in which fracture flow (CSF), intergranular flow (CSI), and fracture and intergranular flow (CSIF) dominate; igneous rocks (I); and unconsolidated sedimentary rocks (U)

Because most of the rural population of Africa depends on groundwater, the density of rural population can be a useful surrogate for groundwater use. [MacDonald and Davis \(2000\)](#) assessed the relative importance, in terms of groundwater use, of the four main hydrogeological provinces (aquifer types) in sub-Saharan Africa, based on estimates of the rural population living in each one. They estimated that up to 220 million people live in rural areas on Precambrian basement, 45 million on volcanic rocks, 110 million on consolidated sedimentary rocks, and 60 million on unconsolidated sediments in sub-Saharan Africa. Most of these people are likely to be dependent on groundwater for much of their water supply.

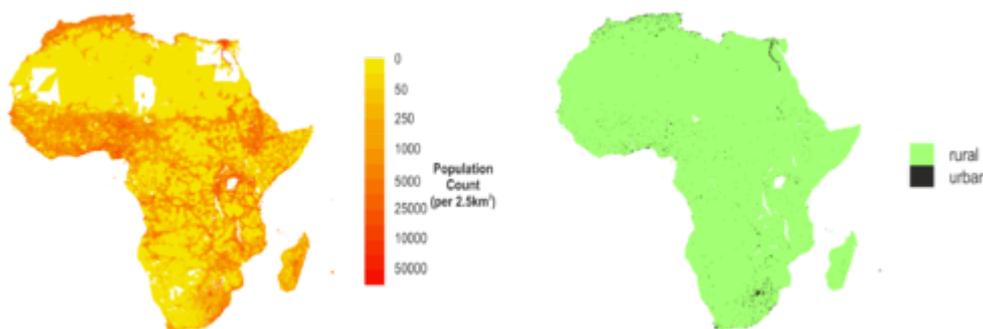
This assessment has been extended over the whole of Africa and re-calculated based on the updated [hydrogeology map of Africa](#) developed by BGS. Gridded datasets of population (total and rural/urban) and the extent of urban areas across Africa were processed to provide an estimate of

the number of people living on each main aquifer type, and what proportion of this population lives in rural and urban areas (UNEP/GRID; Balk et al. 2006; CIESEN, IFPRI, The World Bank, and CIAT 2011).

The study estimated rural populations on each of the main aquifer types of:

- up to 335 million people living on basement rocks (~30% of the total population of Africa)
- up to 340 million people living on consolidated sedimentary rocks (~31% of the total population of Africa. )
- up to 99 million people living on igneous rocks (~9% of the total population of Africa)
- up to 142 million people living on unconsolidated sedimentary aquifers (~13% of the total population of Africa).

Most of these people will rely on groundwater for domestic use. On the higher productivity aquifers - many of the consolidated sedimentary rocks and unconsolidated sedimentary aquifers - groundwater may be increasingly being used for more economically productive purposes, including agriculture and industry. Further work is planned to extend this analysis and explore this in more detail.



Gridded datasets - population and rural/urban areas - used to approximate groundwater use by aquifer type

## Citations and links to further information

Balk, D L, Deichmann, U, Yetman, G, Pozzi, F, Hay, S I, and Nelson, A. 2006. [Determining Global Population Distribution: Methods, Applications and Data](#). Advances in Parasitology, Vol. 62, 119-156. doi:10.1016/S0065-308X(05)62004-0.

- CIESEN, IFPRI, The World Bank, and CIAT. 2011. [Global Rural-Urban Mapping Project, Version 1 \(GRUMPV1\): Urban Extents Grid](#). Palisades, NY: NASA Socioeconomic Data and Applications Centre (SEDAC). Accessed 30th October 2014.

Note: this dataset was produced by the Centre for International Earth Science Information Network (CIESIN) at Columbia University, the International Food Policy Research Institute (IFPRI), the World Bank, and the Centro Internacional de Agricultura Tropical (CIAT). It is based on a combination of population counts, settlement points, and the presence of night-time lights as observed by a series of US Department of Defence meteorological satellites over several decades.

MacDonald, A M, Davies, J. 2000. [A brief review of groundwater for rural water supply in sub-Saharan Africa](#). British Geological Survey Technical Report, WC/00/033.

Seibert, S, Burke, J, Faures, J M, Frenken, K, Hoogeveen, J, Doll, P, and Portmann, F T. 2010. [Groundwater use for irrigation - a global inventory](#). Hydrol. Earth Syst. Sci., 14, 1863-1880. doi: 10.5194/hess-14-1863-2010.

UNEP/GRID. 2004. African Population Distribution Database. UNEP GRID Sioux Falls.

Note: the [African Population Distribution Database](#) was retrieved on 29 October 2014, but is currently not available. Information on UNEP's population datasets is available at <http://www.un.org/en/development/desa/population/publications/database/index.shtml>

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