

# Hydrogeology of Burundi

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One of the smallest and most densely populated countries in Africa, Burundi was an independent kingdom for over 200 years until the early 20th century. It was then colonised first by Germany, and after the First World War by Belgium, and governed with present day Rwanda as Ruanda-Urundi until independence in 1962. Initially, independent Burundi was a monarchy, but after a period of civil and military unrest the monarchy was abolished and a one-party republic established in 1966. Burundi has continued to experience multiple periods of unrest, sometimes with violence between the Hutu and Tutsi cultural groups, including two periods in which genocide was identified, first in the 1970s and then in the 1990s. Since the 1990s Burundi has had a multi-party state, but has continued to experience periods of political and military unrest, such as disrupted presidential elections and a coup attempt in 2015. After the International Criminal Court (ICC) began to investigate potential human rights crimes by the country, Burundi left the ICC in 2017.

Decades of civil and military unrest has left the national infrastructure in very poor state, including water and sanitation services. The population is mostly rural and employed in subsistence agriculture, but high population density and lack of land access mean many farmers can't support themselves. Pressure to increase agricultural land has resulted in widespread deforestation. Export earnings are also dominated by agriculture (mainly coffee and tea), but these account for only a small proportion of GDP. External aid accounts for over 40% of the national income. Burundi has resources of a number of metal minerals but to date has a relatively small mining industry, of which gold provides the biggest export income. Most of the country's electricity is produced by hydroelectric power.

With relatively high rainfall, Burundi has relatively abundant water resources, but because rainfall and surface water are unevenly distributed both spatially and seasonally, and because water supply infrastructure is poor, there is significant pressure on water resources. Most rural communities rely on groundwater, including from numerous natural springs.

□

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## Compilers

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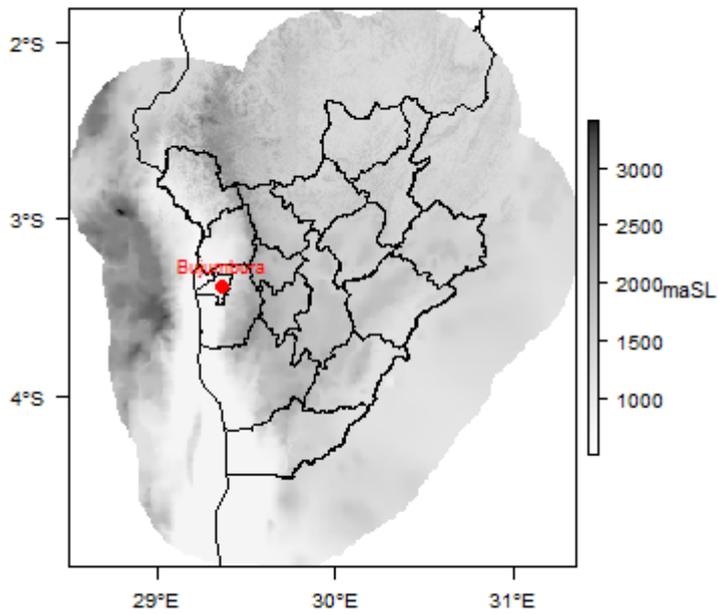
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## Geographical setting



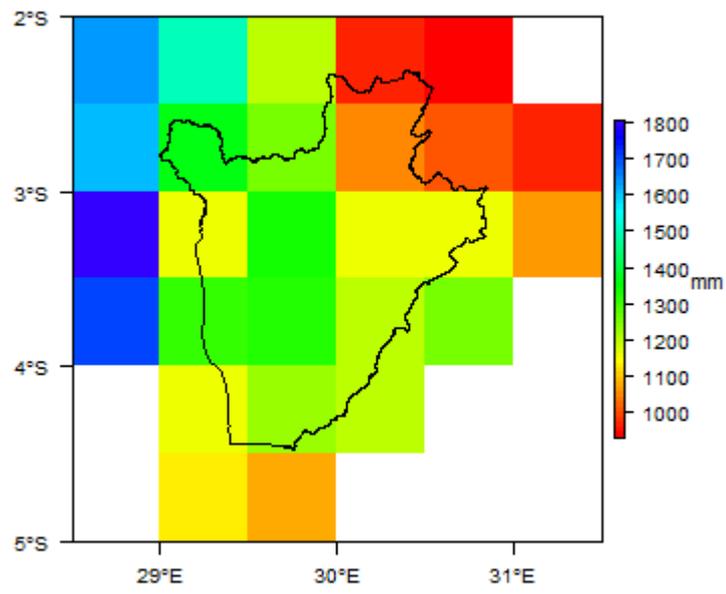
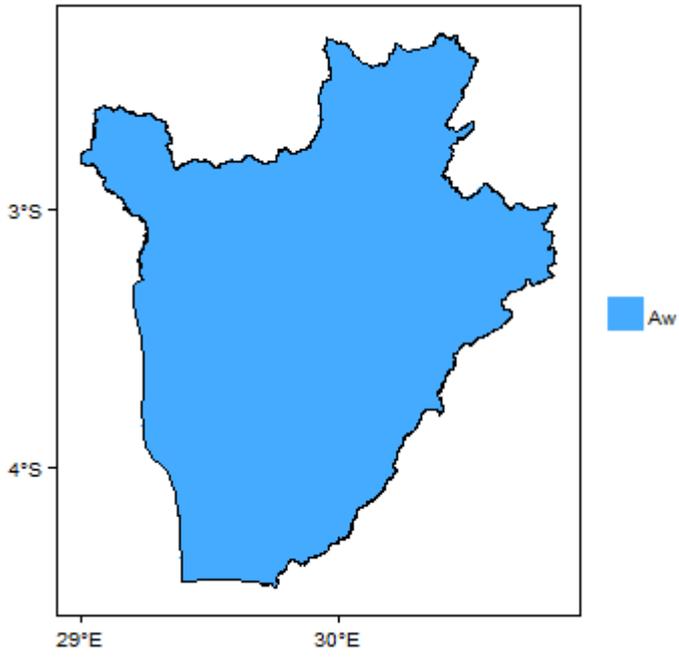
Burundi. Map developed from USGS GTOPOPO30; GADM global administrative areas; and UN Revision of World Urbanization Prospects. For more information on the datasets used to develop the map see the [geography resource page](#))

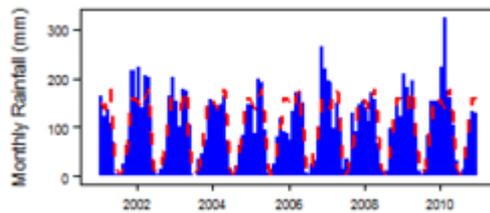
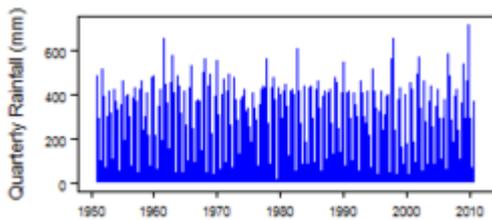
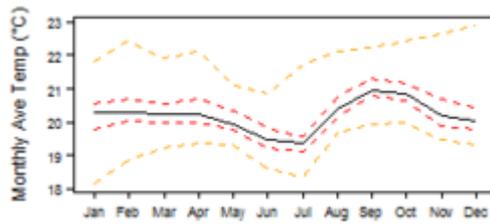
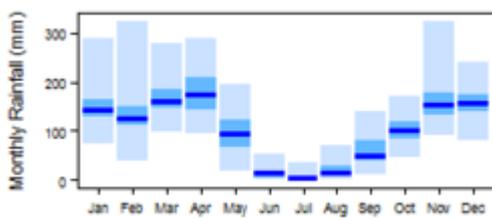
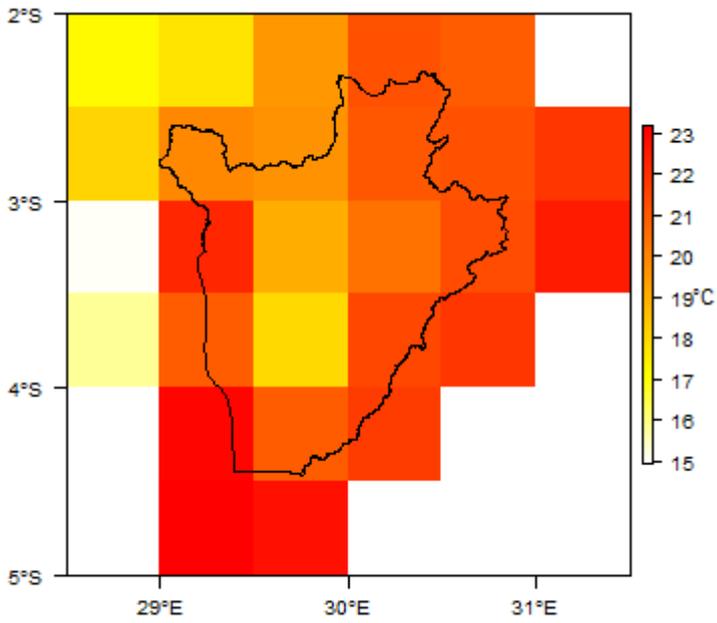
## General

Capital city	Bujumbura
Region	Eastern/Central Africa
Border countries	Rwanda, Tanzania, the Democratic Republic of the Congo
Total surface area*	27,830 km <sup>2</sup> (2,783,000 ha)
Total population (2015)*	11,179,000
Rural population (2015)*	9,875,000 (88%)
Urban population (2015)*	1,304,000 (12%)
UN Human Development Index (HDI) [highest = 1] (2014)*	0.3999

\* Source: [FAO Aquastat](#)

## Climate

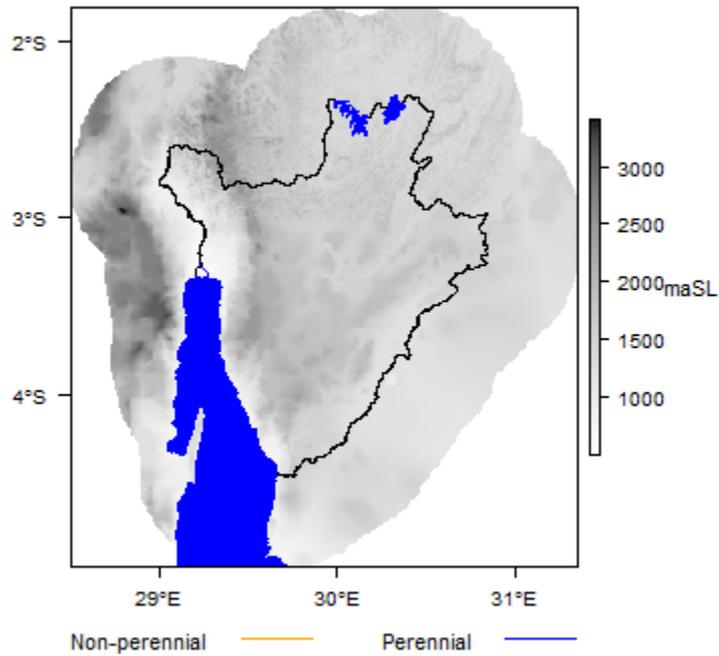




These maps and graphs were developed from the CRU TS 3.21 dataset produced by the Climatic Research Unit at the University of East Anglia, UK. For more information see the [climate resource page](#).

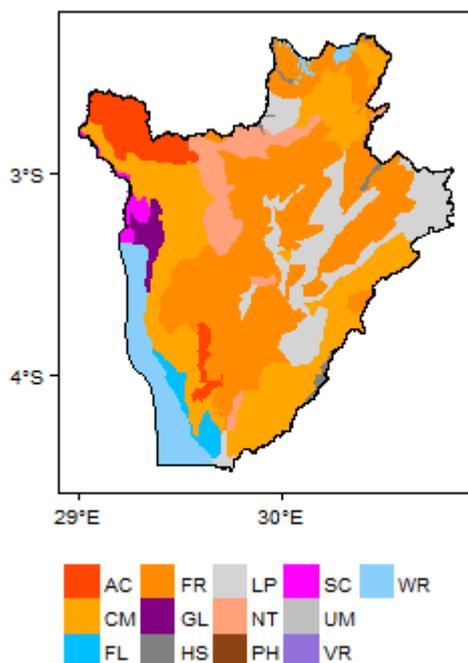
## Surface water

Burundi has relatively abundant surface water resources, because of high rainfall and storage in marshes and lakes. A dense hydrographic network means that it has a high hydroelectric potential. Among the internal rivers are the: Kaburantwa, Kagunuzi, Mpanda, Murembwe, Mugere, Mubarazi, Muhira, Mutsindosi, and Ruvubu rivers. There are also large areas of marshes, and the major lakes Cohoha and Rweru (African Development Fund 2005).



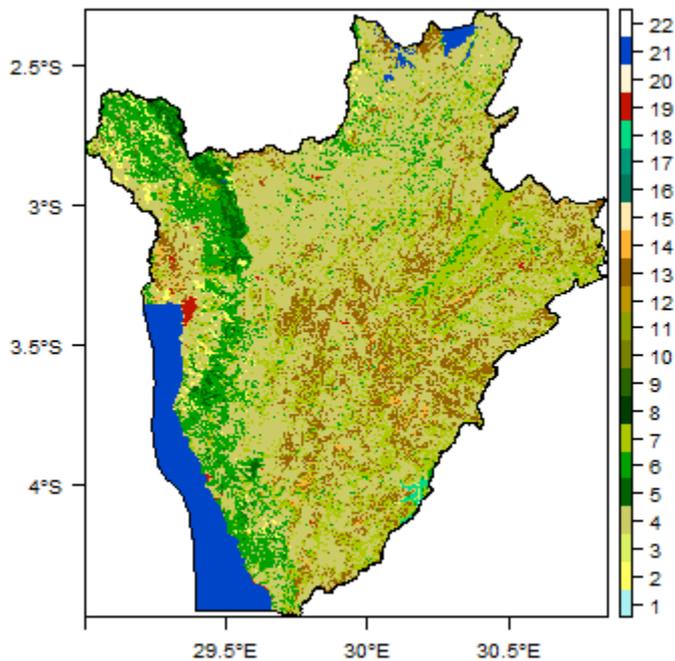
Major surface water features of Burundi. Map developed from World Wildlife Fund HydroSHEDS; Digital Chart of the World drainage; and FAO Inland Water Bodies. For more information on the datasets used to develop the map see the [surface water resource page](#)

## Soil



Soil Map of Burundi, from the European Commission Joint Research Centre: European Soil Portal. For more information on the map see the [soil resource page](#)

## Land cover



Land Cover Map of Burundi, from the European Space Agency GlobCover 2.3, 2009. For more information on the map see the [land cover resource page](#)

## Water statistics

	1998	2000	2005	2014	2015
Rural population with access to safe drinking water (%)					73.8
Urban population with access to safe drinking water (%)					91.1
Population affected by water related disease	No data				
Total internal renewable water resources (cubic metres/inhabitant/year)				899.9	
Total exploitable water resources (Million cubic metres/year)	No data				
Freshwater withdrawal as % of total renewable water resources		2.297			
Total renewable groundwater (Million cubic metres/year)				7,470	
Exploitable: Regular renewable groundwater (Million cubic metres/year)	No data				
Groundwater produced internally (Million cubic metres/year)				7,470	
Fresh groundwater withdrawal (primary and secondary) (Million cubic metres/year)	No data				
Groundwater: entering the country (total) (Million cubic metres/year)					
Groundwater: leaving the country to other countries (total) (Million cubic metres/year)					
Industrial water withdrawal (all water sources) (Million cubic metres/year)				15	

Municipal water withdrawal (all water sources) (Million cubic metres/year)					43.1
Agricultural water withdrawal (all water sources) (Million cubic metres/year)				222	
Irrigation water withdrawal (all water sources) <sup>1</sup> (Million cubic metres/year)				200	
Irrigation water requirement (all water sources) <sup>1</sup> (Million cubic metres/year)				28.4	
Area of permanent crops (ha)					350,000
Cultivated land (arable and permanent crops) (ha)					1,550,000
Total area of country cultivated (%)					55.7
Area equipped for irrigation by groundwater (ha)	No data				
Area equipped for irrigation by mixed surface water and groundwater (ha)	No data				

These statistics are sourced from [FAO Aquastat](#). They are the most recent available information in the Aquastat database. More information on the derivation and interpretation of these statistics can be seen on the FAO Aquastat website.

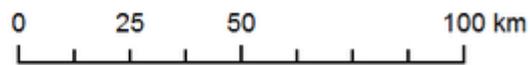
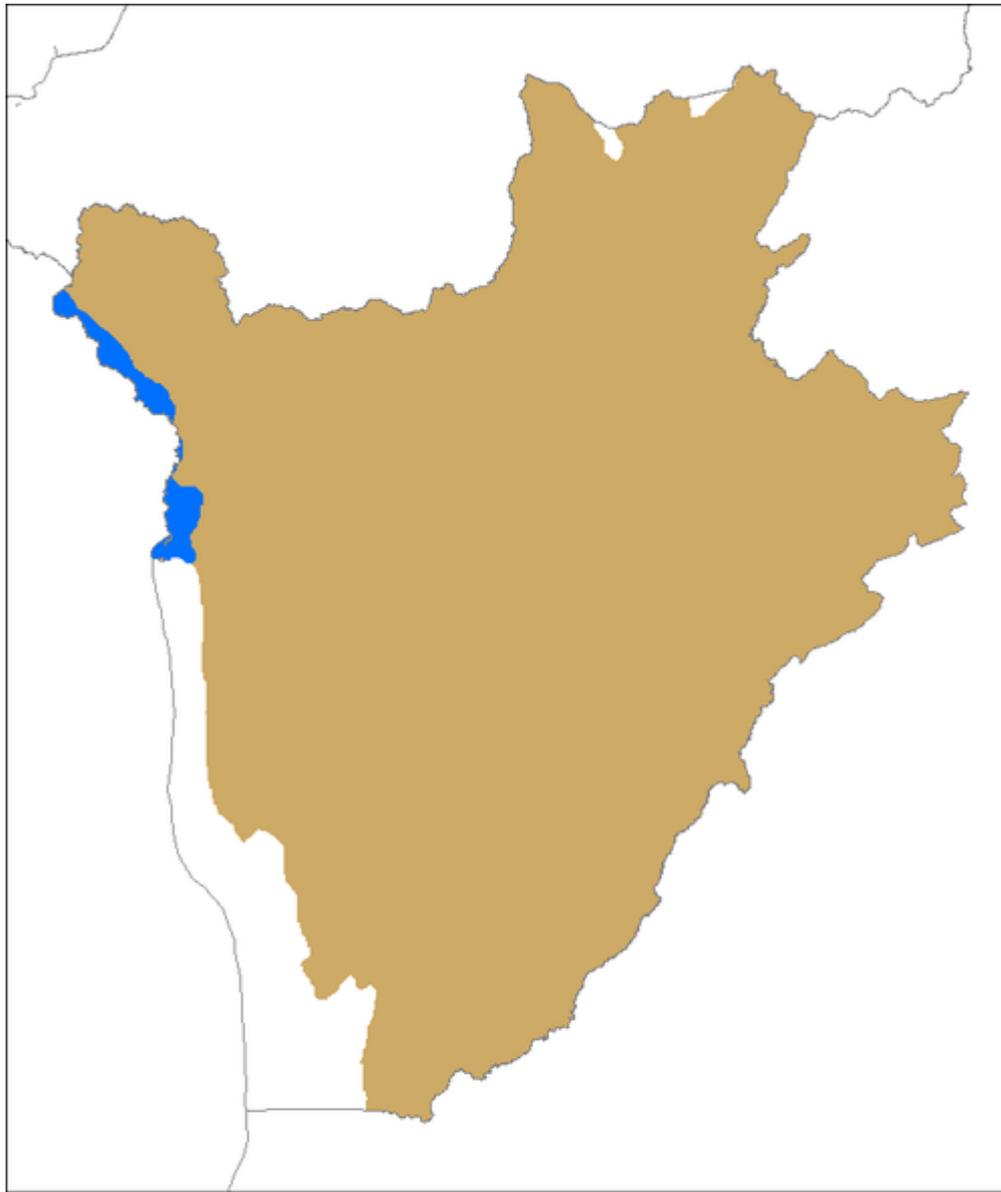
Further water and related statistics can be accessed at the [Aquastat Main Database](#).

<sup>1</sup> More information on [irrigation water use and requirement statistics](#)

## Geology

The geology map shows a simplified version of the geology at 1:5 million scale.

Some more information on the geology of Burundi is available in the report [United Nations \(1989\)](#) and in [Schlüter \(2006\)](#).



### Burundi - Geology

■ Quaternary unconsolidated sedimentary

■ Precambrian basement undifferentiated

Geology of Burundi at 1:5 million scale. Based on map described by Persits et al. 2002/Furon and Lombard 1964. For more information on the map development and datasets see the [geology resource page](#).

### Summary

The geology of Burundi is dominated by Precambrian basement rocks, mostly of Proterozoic age.

		Geological environments
Key formations	Period	Lithology
		<b>Unconsolidated</b>

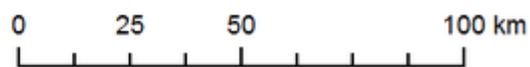
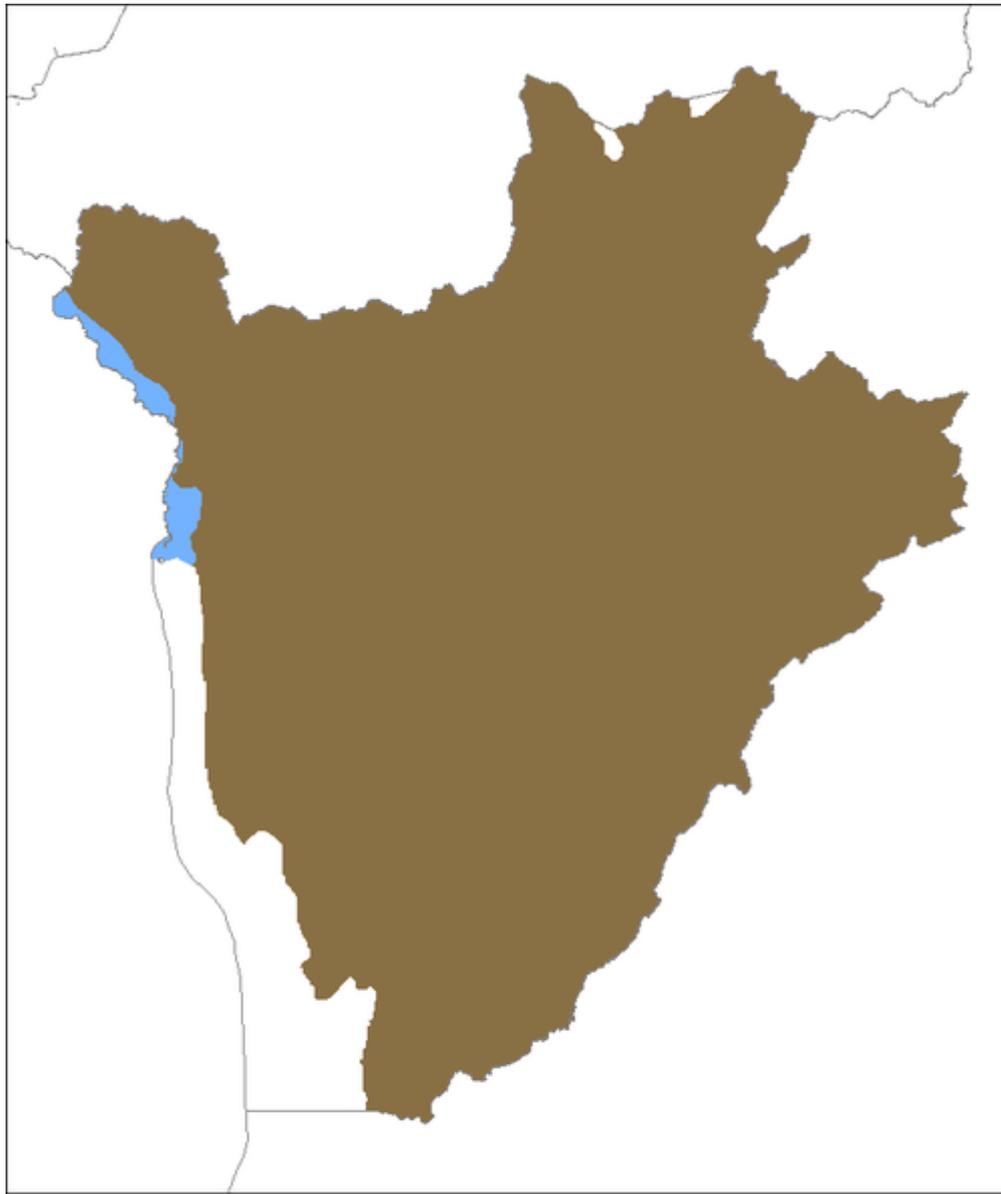
Alluvium and lake sediments	Quaternary-Tertiary	Unconsolidated sediments that mainly infill the major tectonic rift valley in the west of Burundi, running down to Lake Tanganyika. These sediments comprise mainly alluvial sands, silts, gravels and clays. There are also smaller outcrops of alluvium in smaller river valleys and around lakes across the country, which are too small to be shown on this map.
	Cenozoic	<p><b>Volcanic rocks</b></p> <p>A small area of basaltic rocks is present in the extreme northwest of Burundi, but its outcrop is too small to be shown on the 1:5 million scale map.</p> <p><b>Precambrian</b></p> <p><b>A number of different units within the Precambrian are named, with complex outcrops across the country (e.g. see Schlüter 2006, UN 1988). These are not distinguished on this geology map because of its small scale. The main divisions are described below.</b></p>
Malagarasian Supergroup		Metasedimentary rocks, largely schist and quartzite, which outcrop in a narrow strip along the southeast border with Tanzania (UN 1989). This is equivalent to the Bukoban System in northwestern Tanzania (Schlüter 2006).
Burundian Supergroup	Middle Proterozoic	Metasedimentary rocks, largely quartzite with minor amounts of intercalated schist. These Burundian rocks cover most of Burundi, including all of the centre of the country (United Nations 1989). The group is also sometimes known as the Kibaran Belt.
Archean complex	Lower Proterozoic	Highly deformed metamorphic rocks, mainly gneiss, intercalated with amphibolite and quartzite. These rocks crop out only in small parts of the south and east of the country (United Nations 1989).

## Hydrogeology

The hydrogeology map below shows a simplified version of the type and productivity of the main aquifers at 1:5 million scale (see the [hydrogeology map](#) resource page for more details).

More information on the hydrogeology of Burundi is available in these documents:

- a number of reports from the groundwater project [Management and Protection of Groundwater Resources](#) in Burundi carried out by BGR;
- a report by BRGM (2016) on [mapping groundwater availability in basement rocks](#) (page 64), which includes a map of groundwater potential in Burundi (see also Gutierrez and Barrat 2016 in References section, below); and
- a report by United Nations (1989) on [groundwater in Burundi](#).



**Burundi - Aquifer Type and Productivity**

- Unconsolidated - Variable (Low to High) Productivity
- Basement - Low to Moderate (occasionally High) Productivity

Hydrogeology of Burundi at 1:5 million scale. For more information on how the map was developed see the [hydrogeology map](#) resource page

**Unconsolidated**

Aquifer  
Productivity

Named Aquifers and General Description

Recharge

Variable Productivity (Low to High)	<p>These unconsolidated alluvial sediments have variable aquifer properties, depending largely on lithology. Where the alluvium is dominated by coarser grained deposits (gravel and coarse sand), storage capacity and transmissivity may be high. The only areas known in Burundi where alluvial sediments are thick enough to form productive aquifers are on the Moso Plain in south Burundi and Imbo Valley in west Burundi (Gutierrez and Barrat 2016). However, there may be other smaller alluvial aquifers in other smaller valleys, which have local potential.</p>	Recharge is generally high, fed by both rainfall and close hydraulic connection with rivers and valley wetlands.
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## Volcanic

Aquifer Productivity	Named Aquifers and General Description
Unknown Productivity	Little or nothing is known about groundwater in the small areas of volcanic rocks in Burundi.

## Weathered, Fractured Basement

Aquifer Productivity	<p>Named Aquifers and General Description</p> <p>The productivity of the basement aquifer depends on the localised nature and extent of fracturing and weathering - how thick is the weathered zone and how developed are water-bearing fractures? A thick weathered zone - in some parts of granite and schist basement, such as at Kirundo, this can be up to 100 m (Gutierrez and Barrat 2016) - can provide significant groundwater storage potential. Where tectonic activity has caused increased rock fracturing, such as in fault zones, local basement aquifer productivity can be moderate or high. Fracturing may also, however, act to compartmentalise an aquifer and reduce groundwater flow, which can affect the long-term sustainable yield of a borehole - for example, as suggested in Gitega in central Burundi (Pfunt et al. 2016). BGR have carried out <a href="#">hydrogeological studies</a> of the basement aquifer at sites at Gitega (the second largest city in Burundi), Kirundo and Rumonge.</p>
Variable Productivity (generally Low to Moderate but sometimes High)	<p>Data from the Nyanzare wellfield at Gitega where boreholes abstract from fractured zones in the fractured schist and amphibolitic basement indicate that appropriately sited boreholes in the basement aquifer have typical transmissivity values of between 20 and 500 m<sup>2</sup>/day, possibly up to 700 m<sup>2</sup>/day (Tiberghien et al. 2014, Pfunt et al. 2016). Borehole yields of up to 60 m<sup>3</sup>/hour are reported (Gutierrez and Barrat 2016), but compartmentalisation of the aquifer by fracturing suggests that these abstraction rates are not likely to be sustainable (Pfunt et al. 2016). <a href="#">BGR</a> quote transmissivity values of around 35 m<sup>2</sup>/day, and borehole yields of up to 20 m<sup>3</sup>/hour, from the weathered zone of granites at Kirundo. However, more typical borehole yields across most of the basement aquifer are likely to be lower: from around &lt;0.5 to 5 m m<sup>3</sup>/hour (Gutierrez and Barrat 2016).</p> <p>Groundwater levels (water table) in the basement aquifer at Gitega are around 15 m below ground level in the base of the valley (Pfunt et al. 2016); they may be deeper at higher elevations.</p>

## Groundwater use and management

## Groundwater use

Most groundwater used in Burundi is from springs: in 2016 a report said that some 22,000 springs were used for water in 2010, compared to no more than 30 boreholes (Gutierrez and Barrat 2016). An earlier report (African Development Bank 2005) showed that at one point there were at least 35,000 developed natural springs in Burundi tapping groundwater for water supply, and 811 groundwater-based drinking water systems (likely to be drilled or dug wells equipped with hand pumps), but that most of these were non-functional. Lack of infrastructure development means there has been relatively little borehole drilling for water supply. In rural areas it is likely that people make use of groundwater from hand dug wells, possibly on a seasonal basis, as well as the numerous natural springs.

## Groundwater management

Years of political instability have contributed to Burundi's water sector being in very poor state.

Several government bodies share responsibility for water resources and supplies. This can cause poor coordination of planning and water resource development, with competition in the allocation of water between sectors. The institutions involved include (USAID 2010):

- The **Directorate General for Water and Energy of the Ministry of Water, Energy and Mines**, which leads overall water policy formulation
- The **Directorate of Water Resources (DRH)**, which develops and maintains the national water master plan
- The **Directorate General of Rural Water and Electricity (DGHER)**, which oversees rural drinking water and sanitation
- The **Water and Electric Authority ((REGIDESO)**, which is responsible for urban service provision
- **Communal Water Authorities**, which are responsible for rural service provision and linked to District Users committees (African Development Fund 2005).

General improvement of water supplies in Burundi is a policy and development priority, and the urgency of this task means that there is a broad focus on all aspects of water resources and supply. Policies are focussed on implementing the principles of community based management and integrated water resource management (IWRM).

There is an attempt by government and some donors to encourage the development of the small amount of private sector involvement in the water sector. In 2005, the African Development Fund estimated there were 30 private consultancy firms in Burundi active in water services, such as borehole drilling.

A database which in 2009 had limited information about groundwater sources. A GTZ-supported project included work to develop a central database at the national water authority.

## Transboundary aquifers

For general information about transboundary aquifers, please see the [Transboundary aquifers resources page](#)

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References with more information on the geology and hydrogeology of Burundi can be accessed through the [Africa Groundwater Literature Archive](#).

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