

Hydrogeology of Gambia

From Earthwise

[Jump to navigation](#) [Jump to search](#)

[Africa Groundwater Atlas](#) >> [Hydrogeology by country](#) >> Hydrogeology of the Gambia



This work is licensed under a [Creative Commons Attribution-ShareAlike 3.0 Unported License](#)

The Republic of the Gambia is the smallest mainland African country. By the 14th century, most of what is now Gambia was part of the Mali empire. From the 15th century, many European powers established trading posts in the Senegambia area, which included the Malinke and Wolof kingdoms and was also inhabited by the pastoral nomadic Fulani who are found throughout West Africa. Portuguese traders were followed by colonial rule from first Britain, then France, then Britain again from the late 16th century. The Gambia won independence in 1965, and saw relatively stable government until an attempted coup in 1981, in the aftermath of which the Gambia and Senegal formed the Senegambia Confederation in 1982. The Gambia withdrew from the confederation in 1989. Another military uprising in 1994 saw the first change in president since independence, with a full return to democratic elections in 2001. The second president was ousted in elections in 2017. Gambia left the Commonwealth in 2013 and applied to return in 2018.

The Arab and then transatlantic slave trades were dominant economic activities from the 10th to the 19th centuries. Today, agriculture accounts for around 30% of GDP and employs about 70% of the labour force, with groundnuts for export a particularly important crop, although rice has been promoted in an attempt to diversify the agricultural economy. Manufacturing is largely based on agriculture, including groundnut processing. The port of Banjul is important in the export and re-export of agricultural products. Services, particularly tourism, account for about 60% of GDP: the tourism sector is largely built around the ecology and wildlife of the Gambia River floodplain.

The Gambia has plentiful surface water in the Gambia River, but this is rarely used for potable water supply because of poor water quality: the highest water demand, in population centres and tourism facilities, is in the coastal areas, where the river has high salinity. Highly seasonal rainfall and a lack of smaller perennial rivers away mean that most potable water demand, in rural and urban areas, is met by groundwater.

□

Contents

- [1 Authors](#)
- [2 Terms and conditions](#)
- [3 Geographical Setting](#)
 - [3.1 General](#)
 - [3.2 Climate](#)
 - [3.3 Surface water](#)
 - [3.4 Soil](#)
 - [3.5 Land cover](#)
 - [3.6 Water statistics](#)
- [4 Geology](#)
- [5 Hydrogeology](#)
 - [5.1 Unconsolidated](#)
- [6 Groundwater Status](#)
- [7 Groundwater use and management](#)
 - [7.1 Groundwater use](#)
 - [7.2 Groundwater management](#)
 - [7.3 Groundwater monitoring](#)
- [8 References](#)
 - [8.1 Geology References](#)
 - [8.2 Hydrogeology References](#)
- [9 Return to the index pages](#)

Authors

Landing Bojang, Department of Water Resources, The Gambia

Giran Corr, RC Engineering / NIRAS, The Gambia

Dr Kirsty Upton, Brighid Ó Dochartaigh, British Geological Survey, UK

Dr Imogen Bellwood-Howard, Institute of Development Studies, UK

Please cite this page as: Bojang, Corr, Upton, Ó Dochartaigh and Bellwood-Howard, 2018.

Bibliographic reference: Bojang L, Corr G, Upton K, Ó Dochartaigh BÉ and Bellwood-Howard, I. 2018. Africa Groundwater Atlas: Hydrogeology of the Gambia. British Geological Survey. Accessed [date you accessed the information]. http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Gambria

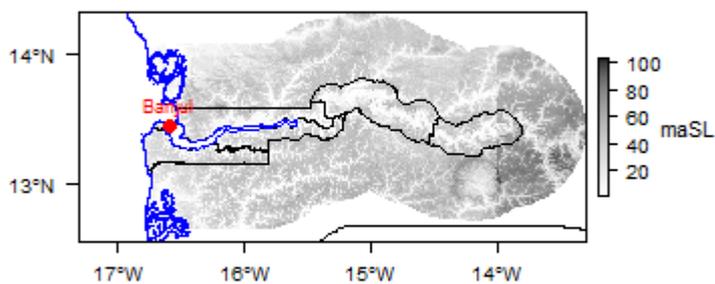
Terms and conditions

The Africa Groundwater Atlas is hosted by the British Geological Survey (BGS) and includes information from third party sources. Your use of information provided by this website is at your own risk. If reproducing diagrams that include third party information, please cite both the Africa Groundwater Atlas and the third party sources. Please see the [Terms of use](#) for more information.

Geographical Setting

General

The Gambia is the smallest country in Africa. It borders the Atlantic Ocean to the west, and is otherwise entirely surrounded by the country of Senegal. The majority the country comprises the floodplain of the Gambia River, which originates in Guinea before flowing through Senegal and through the Gambia to the sea. The country is therefore generally very flat, ranging from 0 to <100 m above sea level.



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

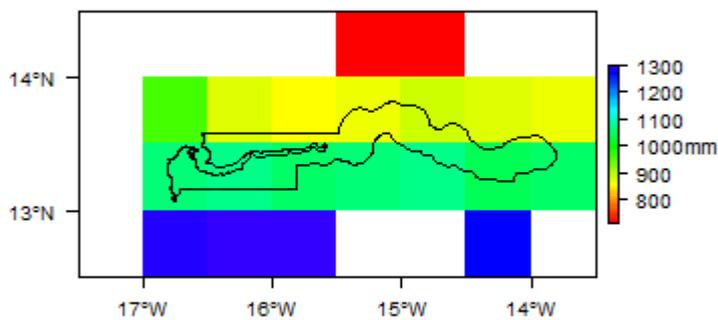
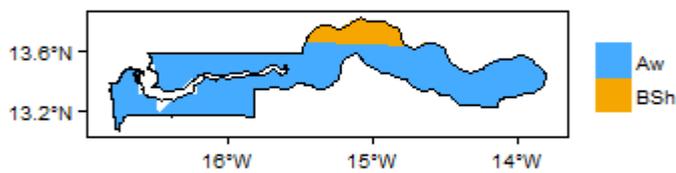
Capital city	Banjul
Region	West Africa
Border countries	Senegal
Total surface area*	11,300 km ² (1,130,000 ha)
Total population (2015)*	
Rural population (2015)*	816,000 (41%)
Urban population (2015)*	1,175,000 (59%)
UN Human Development Index (HDI) [highest = 1] (2014)*	0.4406

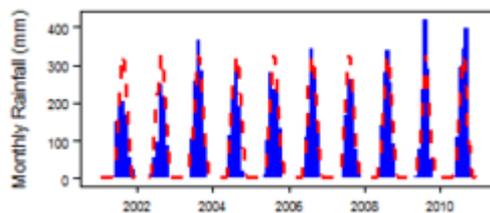
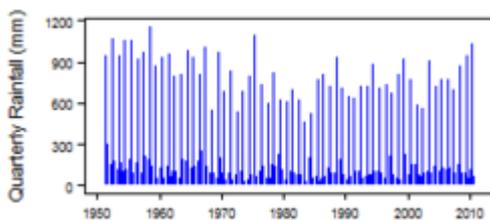
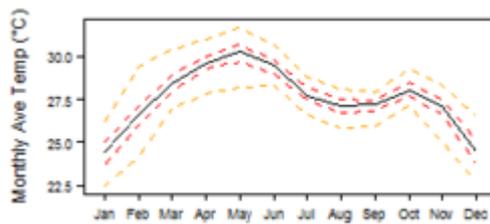
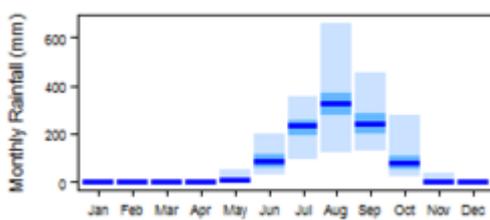
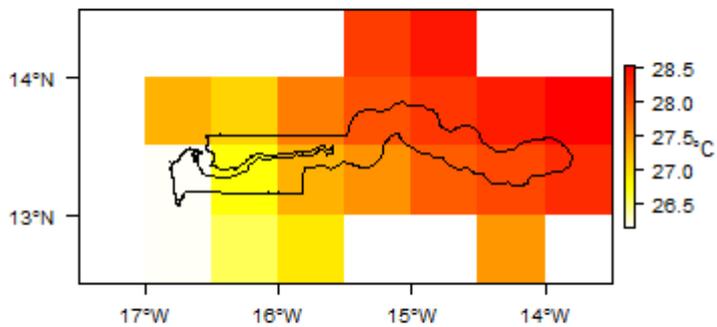
* Source: [FAO Aquastat](#)

Climate

The climate of the Gambia is largely classified as tropical savannah, apart from the central north region which transitions into hot, arid steppe. There is little spatial variation in average annual precipitation and temperature, other than a slight reduction in rainfall in the central north region.

Gambia has a very distinct wet season between June and October, and is relatively dry from November to April. The wet season is relatively hot compared to the cooler dry season.





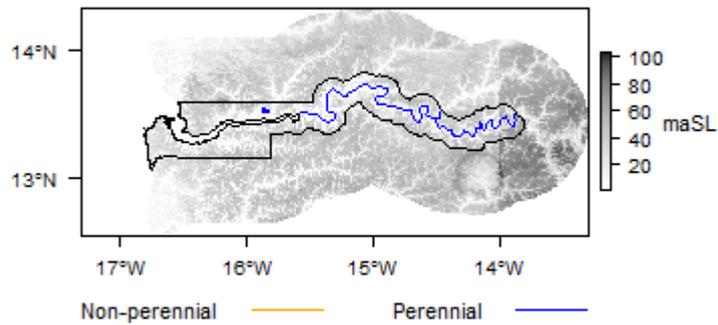
More information on average rainfall and temperature for each climate zone in Gambia can be found on the [Gambia Climate Page](#).

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

The Gambia is dominated by the perennial Gambia River, which has its source in Guinea and flows through Senegal before flowing along the entire length of the Gambia from the east to its discharge point to the Atlantic Ocean to the west. Its flow is highly seasonal, with maximum flows at the end of the rainy season in late September-October

The Department of Water Resources is responsible for river flow gauging, and currently monitors the Gambia River close to its discharge point to the Atlantic Ocean.



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

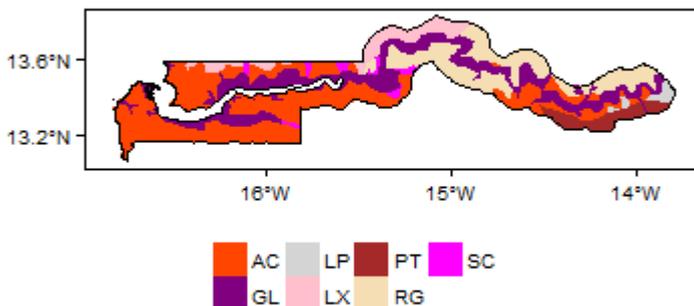
Soil

Soils across the floodplain of the Gambia River are dominantly Gleysols, which are highly important for agriculture.

Lixisols in the north of the country are associated with fine-grained weathered parent material, and natural savannah or open woodland vegetation.

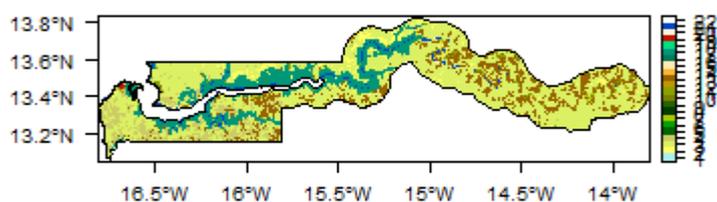
More acidic Acrisols are found in the coastal region. This soil type is common in the wetter parts of Africa, and is generally deficient in nutrients.

Regosols, which cover a significant area inland, are reflective of the largely unconsolidated underlying geological deposits.



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

Water statistics

	1999	2000	2005	2014	2015
Rural population with access to safe drinking water (%)					84.4
Urban population with access to safe drinking water (%)					94.2
Population affected by water related disease	No data				
Total internal renewable water resources (cubic metres/inhabitant/year)				1,507	
Total exploitable water resources (Million cubic metres/year)	No data				
Freshwater withdrawal as % of total renewable water resources		1.131			
Total renewable groundwater (Million cubic metres/year)				500	
Exploitable: Regular renewable groundwater (Million cubic metres/year)	No data				
Groundwater produced internally (Million cubic metres/year)				500	
Fresh groundwater withdrawal (primary and secondary) (Million cubic metres/year)	No data				
Groundwater: entering the country (total) (Million cubic metres/year)	No data				
Groundwater: leaving the country to other countries (total) (Million cubic metres/year)	No data				
Industrial water withdrawal (all water sources) (Million cubic metres/year)			21.2		

Municipal water withdrawal (all water sources) (Million cubic metres/year)					41.2
Agricultural water withdrawal (all water sources) (Million cubic metres/year)	39.2				
Irrigation water withdrawal (all water sources) ¹ (Million cubic metres/year)	39.2				
Irrigation water requirement (all water sources) ¹ (Million cubic metres/year)	12				
Area of permanent crops (ha)					5,000
Cultivated land (arable and permanent crops) (ha)					445,000
Total area of country cultivated (%)					39.38
Area equipped for irrigation by groundwater (ha)	15				
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](#).

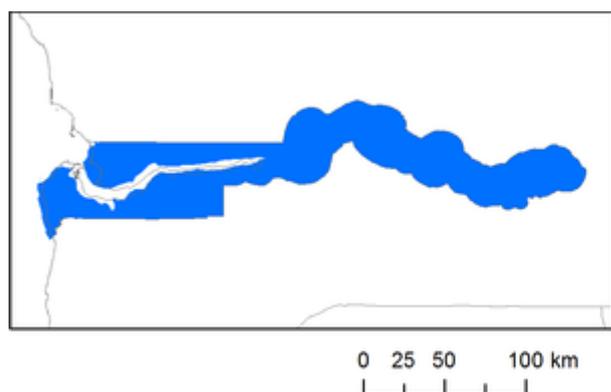
¹ More information on [irrigation water use and requirement statistics](#)

Geology

This section provides a summary of the geology of the Gambia.

The geology map on this page shows a simplified version of the geology at a national scale (see the [geology resource page](#) for more details).

[Download a GIS shapefile of the Gambia geology and hydrogeology map.](#)



Gambia - Geology

■ Unconsolidated sedimentary overlying Mauritanian/Senegal Basin consolidated sedimentary
 Geology of the Gambia at 1:5 million scale. Developed from USGS map (Persits et al. 2002). For more information on the map development and datasets see the [geology resource page](#). [Download a GIS shapefile of the Gambia geology and hydrogeology map.](#)

Key Formations	Period	Lithology	Structure
Unconsolidated Sedimentary Deposits	Quaternary	<p>Unconsolidated</p> <p>Unconsolidated deposits of Quaternary age crop out across the whole country. They consist of Holocene aeolian sands/silts and alluvial clays, underlain by Pleistocene sandy clays and Pliocene fine-medium grained sands which contain varying amounts of silt, clay and laterites.</p> <p>Loosely consolidated deposits, variously of fluvial, lacustrine and marine origin. These Cretaceous and Tertiary deposits are part of the Mauritania/Senegal sedimentary basin, which formed as a result of the breakup of Gondwana in the late Palaeozoic/early Mesozoic. The Tertiary sediments are largely composed of shales and marly limestones. These can be subdivided into 4 main units:</p> <p>(1) Miocene shales and marly fine sands with subordinate limestones;</p> <p>(2) Oligocene marly limestones, which are of limited extent;</p> <p>(3) Eocene shales and marly limestones with bands of flint near the base;</p> <p>(4) Paleocene limestones interbedded with dark grey marls. Below this are two sequences of Cretaceous loosely consolidated sediments. The younger sediments, of Maestrichtian age, are composed of fine to coarse grained sandstones, with subordinate grey-black shales, phosphatic nodules and lignite bands. The older Cretaceous sediments (of Campanian age) consist of grey clays and marls interbedded with fine calcareous sandstones, dolomite limestones, and lignite bands.</p>	<p>The Holocene deposits are typically up to 20 m thick, while the underlying Pleistocene and Pliocene deposits have thicknesses of around 20 and 30 m, respectively.</p>
		<p>Mauritania/Senegal Basin Sedimentary</p>	<p>Cretaceous-Tertiary</p>

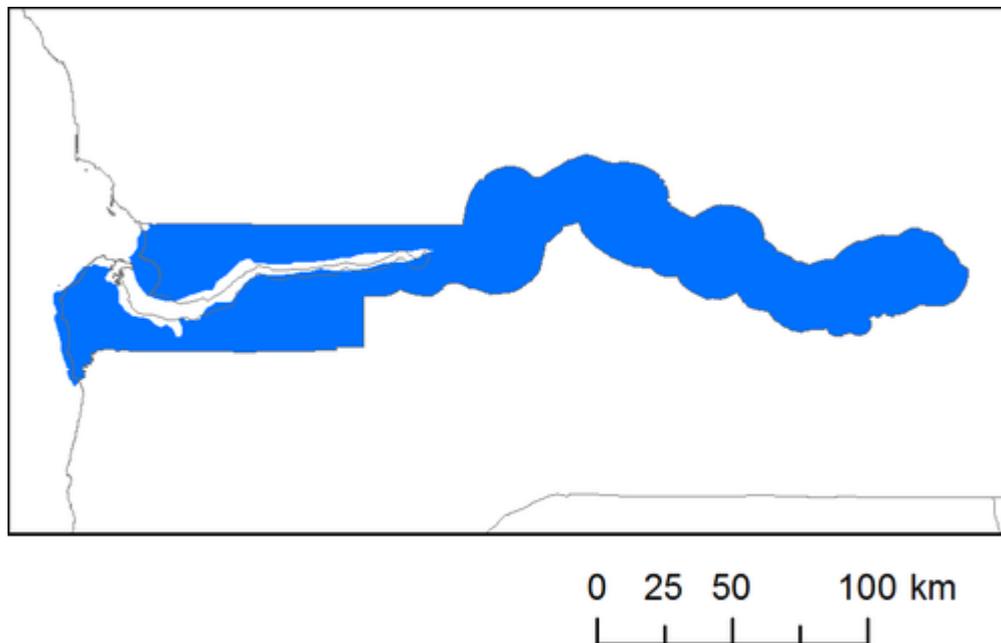
Hydrogeology

This section provides a summary of the hydrogeology of the main aquifers in the Gambia. More information is available in the references listed at the bottom of this page. Many of these references can be accessed through the [Africa Groundwater Literature Archive](#).

The hydrogeology map on this page shows a simplified version of the type and productivity of the main aquifers at a national scale (see the [hydrogeology Map](#) resource page for more details).

[Download a GIS shapefile of the Gambia geology and hydrogeology map.](#)

There are two main aquifers in the Gambia: the upper Quaternary unconsolidated sands comprise a shallow sand aquifer (SSA), which is an important aquifer throughout the Gambia. The deeper Cretaceous sediments form a deep sandstone aquifer (DSA). More detail can be seen below.



Gambia - Aquifer Type and Productivity

Unconsolidated - Very High

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

[Download a GIS shapefile of the Gambia geology and hydrogeology map.](#)

Unconsolidated

Named Aquifers	General Description	Water quantity issues	Water quality issues	Recharge
----------------	---------------------	-----------------------	----------------------	----------

Shallow Sand Aquifer (SSA)	<p>The shallow sand aquifer (SSA) is composed predominantly of fine to coarse sand, and is found and exploited across the extent of Gambia. It can be subdivided into 2 units: the phreatic aquifer, which comprises the Holocene sediments, and the semi-confined aquifer, which comprises the underlying Pliocene sediments. The two aquifers are separated by a 15-30 m clay-silt layer which allows limited hydraulic connection between them. Yields are generally in the range of 1-30 l/s and can be greater than 30 l/s in the most productive areas. Hydraulic conductivity and transmissivity generally ranges from 5-30 m/d and 100-10000 m²/d, respectively. Storage is generally between 10⁻⁴ and 10⁻². The SSA typically varies from 5-25 m thick and the water table may sit between 4 and 50 m below ground level. Boreholes are generally drilled to depths of 35-100 m.</p>	Groundwater abstraction is significantly less than recharge and water levels fully recover during the wet season.	There are no major groundwater quality issues. Isolated instances of elevated iron concentrations have been reported.	When mean annual precipitation is above 900 mm, recharge is generally in the range of 250 - 300 mm. This is a result of direct infiltration.
----------------------------	--	---	---	--

Deep Sandstone Aquifer (DSA)	<p>The deep sandstone aquifer (DSA) comprises mainly unconsolidated sands and loosely consolidated sandstones, typically at depths of 250-450m. Groundwater in the DSA is confined, and is very old water of 'fossil' origin, between 4000 and 40000 years old. Exploitation of the DSA would require deep boreholes (up to 380 m), and potential yields have been estimated at 40 l/s.</p>	<p>Storage in the DSA has been estimated at 650,000 M cubic metres, of which only 80,000 M cubic metres is thought to be potable.</p>	<p>In the east of Gambia, groundwater in the DSA is potable, but in the west the old confined groundwater is typically highly mineralised, with total dissolved solids in the range 1000 to 2000 mg/l, and fluoride concentrations between 2 and 5 mg/l. If required, highly mineralised water in the western parts of the DSA could be abstracted and mixed with groundwater from the SSA at a ratio of 2:1 to expand the exploitable water resources of Gambia.</p>	<p>There is no appreciable modern recharge to the DSA.</p>
------------------------------	---	---	---	--

Groundwater Status

Groundwater abstraction from the main unconsolidated aquifer (SSA) is less than average annual recharge. Total groundwater availability could be significantly increased by exploiting the DSA.

Groundwater use and management

Groundwater use

The national water supply in Gambia is derived entirely from groundwater.

The following groundwater abstractions are currently known: 207 boreholes with hand pumps, 260 boreholes with solar pumping systems, 84 boreholes with electric pumping systems, and 1634 hand dug wells with hand pumps (Department of Water Resources).

Groundwater management

The Department of Water Resources is responsible for the development, utilisation and protection of groundwater in Gambia. They issue permits, which are required for both borehole drilling and groundwater abstraction.

The National Water and Electricity Company (NAWEC) is mandated to provide water supply in the Greater Banjul Area and surrounding provinces.

Groundwater monitoring

The Department of Water Resources established a network of 38 groundwater level and quality monitoring boreholes in 2014. These are distributed across Gambia and are equipped with automatic data loggers. The recorded groundwater level observations are collected every 3 months, and the data is stored in the GeOdin database in the Department of Water Resources.

The same network is used to monitor groundwater quality.

References

Other references relating to the hydrogeology of the Gambia can be found in the [Africa Groundwater Literature Archive](#).

Geology References

Whyte WJ and Russell TS. 1988. Geological and Mineral Map of The Republic of The Gambia. Ministry of Economic Planning and Industrial Development.

Whyte WJ and Russell TS. 1988. Geological Survey of The Gambia. Ministry of Local Government and Lands

Hydrogeology References

1983. Groundwater Resources of The Gambia, Preliminary Report. April 1983

Ceesay S and Humphreys H. 1987. Groundwater Survey Phase I.

Return to the index pages

[Africa Groundwater Atlas](#) >> [Hydrogeology by country](#)

Retrieved from 'http://earthwise.bgs.ac.uk/index.php?title=Hydrogeology_of_Gambia&oldid=44938'
Categories:

- [Hydrogeology by country](#)
- [Africa Groundwater Atlas](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Page](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)



More

Search

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

• This page was last modified on 7 January 2020, at 12:11.

- [Privacy policy](#)
- [About Earthwise](#)
- [Disclaimers](#)

