

WATER RESOURCES

Water Resources in Sudan

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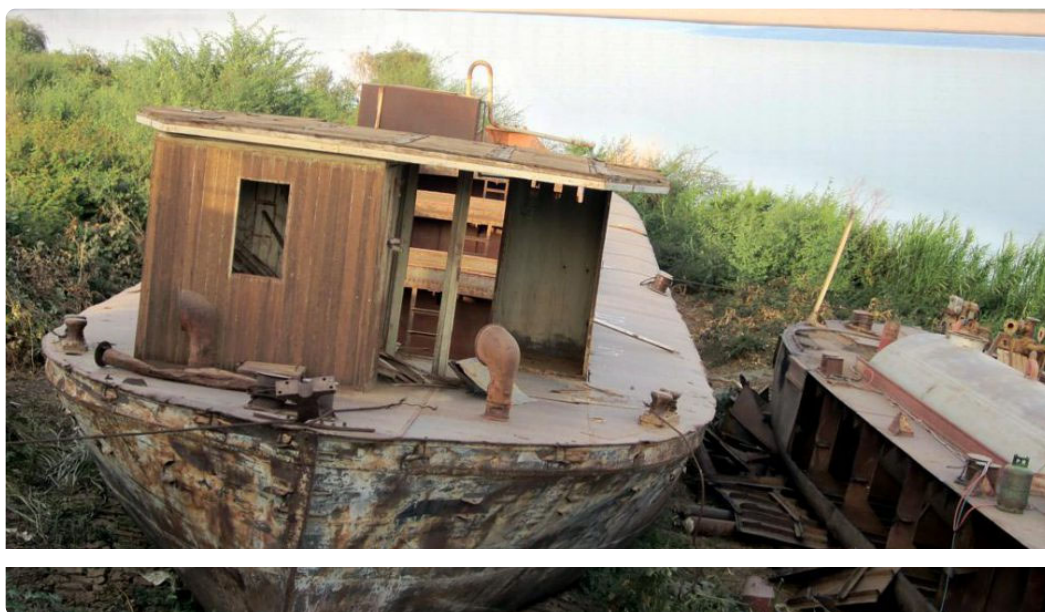


Photo 1: River Nile, Sudan (Source: David Stanley, Flickr).

Contents

Sudan's main water resources are surface water, including rainfall, rivers, seasonal wadis and khors, lakes and wetlands. Groundwater is

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At the watershed level, Sudan comprises seven main basins as shown in Map 1. Figure 2 illustrates the percentage of each basin’s area to the total country.

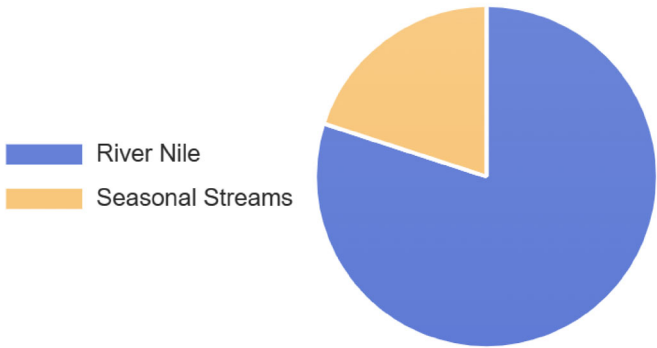


Figure 1: Annual Available Surface Water in Sudan (billion cubic meter).
[\[1\]](#)

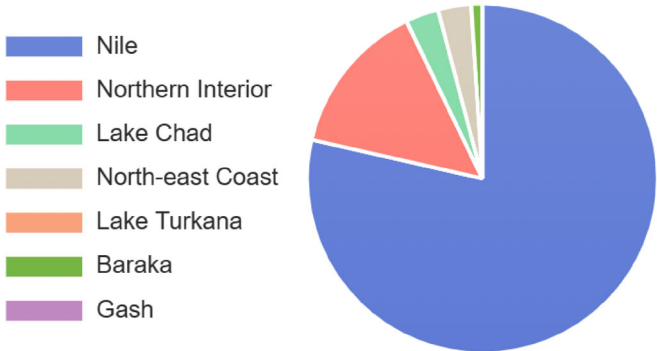


Figure 2: Areas of Sudan's basins (%).



Map 1: Hydrological basins in Sudan. @Fanack water

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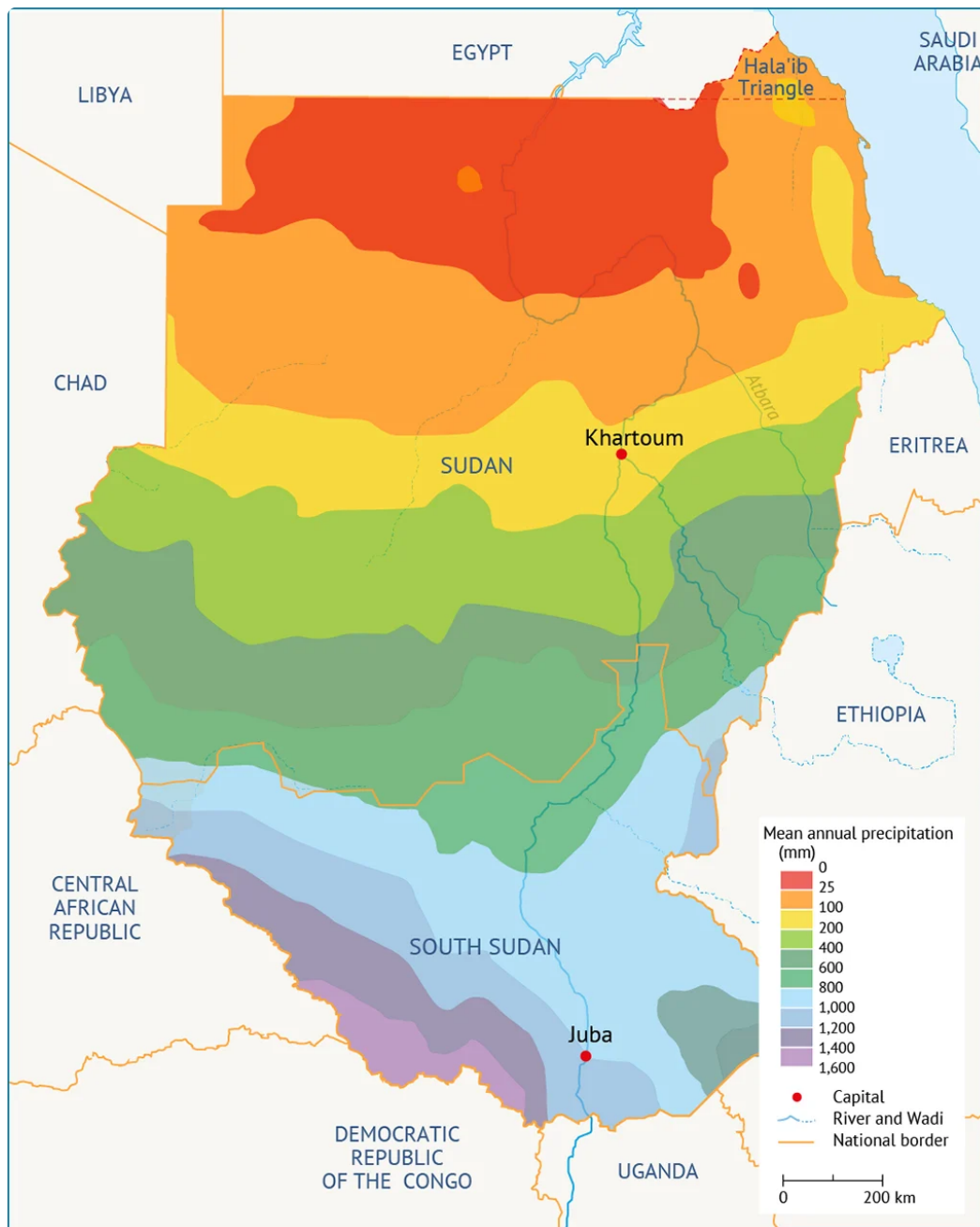
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tributaries. Almost half the Nile River Basin lies within Sudan's borders. Wetlands cover 10% of the country,^[2] whereas forests cover 4%.^[3] There are many seasonal water courses (khors) that run during the short rainy season. Their discharge volumes, flow durations and water quality have never been gauged. The total annual discharge of the relatively perennial rivers, outside the Nile basin, is 7.0BCM. The most important of these are the Gash, Baraka and Khor Arbaat rivers in the east, Wadi Azoom and Galol as well as many others in Darfur, and Khor Abu Habil, which drains the Nuba Mountains of Southern Kordofan.

Rainfall

The estimated annual rainfall in Sudan is about 440 billion cubic metres. The highest rainfall rates are in southernmost parts with 800 mm/year. Precipitation decreases towards the north as the driest areas are between Khartoum, about 120 mm/year, and the border with [Egypt](#), almost zero mm/year. The northern part is characterized by a short rainy season and scattered rainfall.^[5]

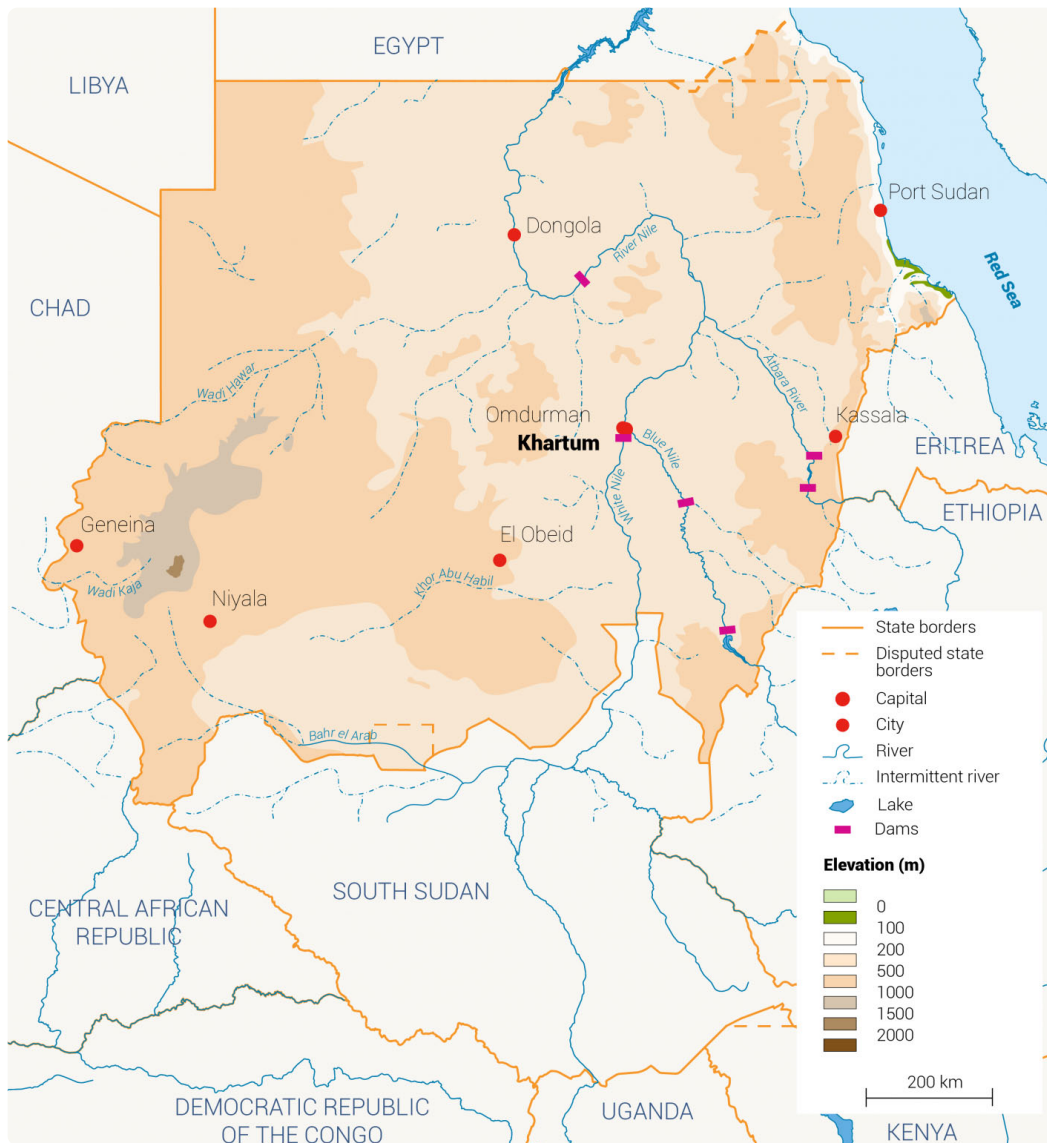
Rainfall deficiency almost occurs throughout the year all over the country as evapotranspiration rates exceed rainfall. Exceptions are months of August, September and part of October. In these months, the runoff enables seasonal watercourses to run and aquifers to recharge. However, runoff water often carries silt and debris, causing erosion of the catchment area. This problem exacerbated due to increasing deforestation.^[6]



Map 2. Average annual rainfall in South Sudan and Sudan. @Fanack water

Nile River

Seventy-three per cent of Sudan's annual freshwater comes from the [Nile River](#) and its tributaries. The Nile Water Agreement of 1959 governs Sudan's annual consumption of the Nile with 18.5 billion cubic meters out of its 80 billion cubic meters annual yield. The majority of this water is from the Blue Nile that originates in Ethiopia, passes from



Map 3. Water Rivers in Sudan. @Fanack water

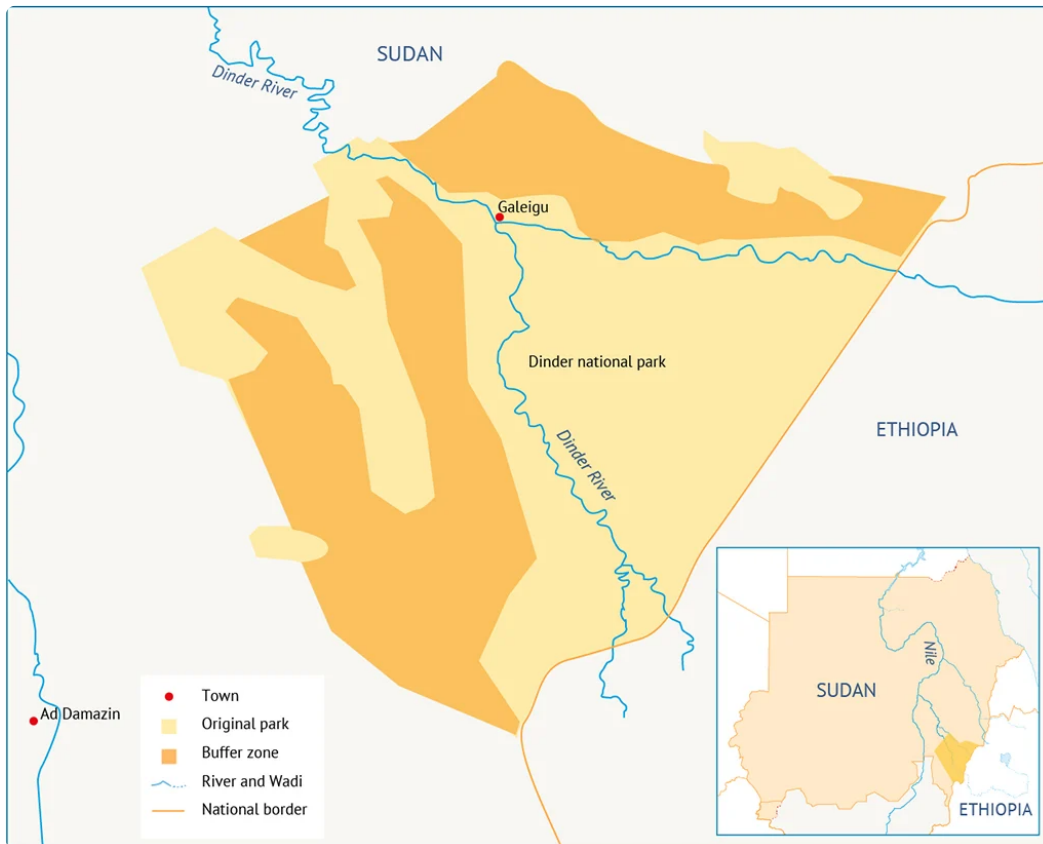
Seasonal Streams

Sudan has several seasonal streams, known as wadis or khors locally. The streams flow from July to October for a few days or hours and are usually dry for the rest of the year. The biggest four streams are shared with neighbouring countries: Gash and Baraka with Eritrea, and Azum and Hawar with Chad, and others with South Sudan and the Central African Republic. Other seasonal streams in Sudan include Khor Abu Habil, Wadi El Mugaddam, Wadi Kaja, Wadi Nyala, Alawataib and Alhawad.[\[8\]](#)

The yield of the seasonal streams depends on the rainfall rate and

Wetlands

There are 30 distinct types of wetlands in Sudan.[10] Three have been designated as Ramsar sites (wetlands of international importance).[11] One of them is the mayas (oxbow lakes) in Dinder National Park (Map 4).[12]



Map 4: Mayaas in Dinder National Park. @Fanack water

Sudan's wetlands include:

- Freshwater lakes. Examples are Er-Rahad, Kundi, Keilak and Abyad in western Sudan. They are rich in biodiversity, especially water fowl and micro-invertebrates.[13]
- Seasonal lakes. These are found in different regions and include Butu Rayia, Um Badir, al-Fula, Ras Amir, Um Baggara, Kibbew,

- Mountain streams include Wadi Shalengo, which drains a catchment area of approximately 8,450km² on the western flank of the Nuba Mountains, and extends south-south-west through a sandstone ridge to discharge into a delta region of approximately 2,200km² around Niama. The southern edge of this delta is drained by the Regaba al-Zarga channel complex, which joins the Bahr al-Ghazal about 150 kilometres downstream of the town of Abyei. Arbaat is the only perennial stream that drains the Red Sea Hills.

Hot springs. Akasha hot springs, at the tail of Lake Nubia, are the most accessible. Others are found in Quella (Jebel Marra), al-Harra (Wadi Azum) and in the Meidoub Hills

Lakes

Sudan has several natural freshwater lakes, including Kundi in southern Darfur, Abyad in Southern Kordofan, and Turdat el-Rahad in Kordofan. Sudan also has saline lakes such as the Dariba crater in Jebel Marra in western Sudan, Malha in Northern Darfur. Beside oases such as Nikheila, Natroon and Saleema are located in the country's north.[\[15\]](#)

Artificial reservoirs were also formed in the country with the construction of dams. These include Sennar and Roseires on the Blue Nile, Jebel Aulia on the White Nile, Khashm El-Girba and the Upper Atbara and Setit Complex on the River Atbara, Merowe in the Northern state, and Lake Nubia in the Northernmost of Sudan as part of the Egyptian High Aswan Dam's reservoir.[\[16\]](#)

Groundwater

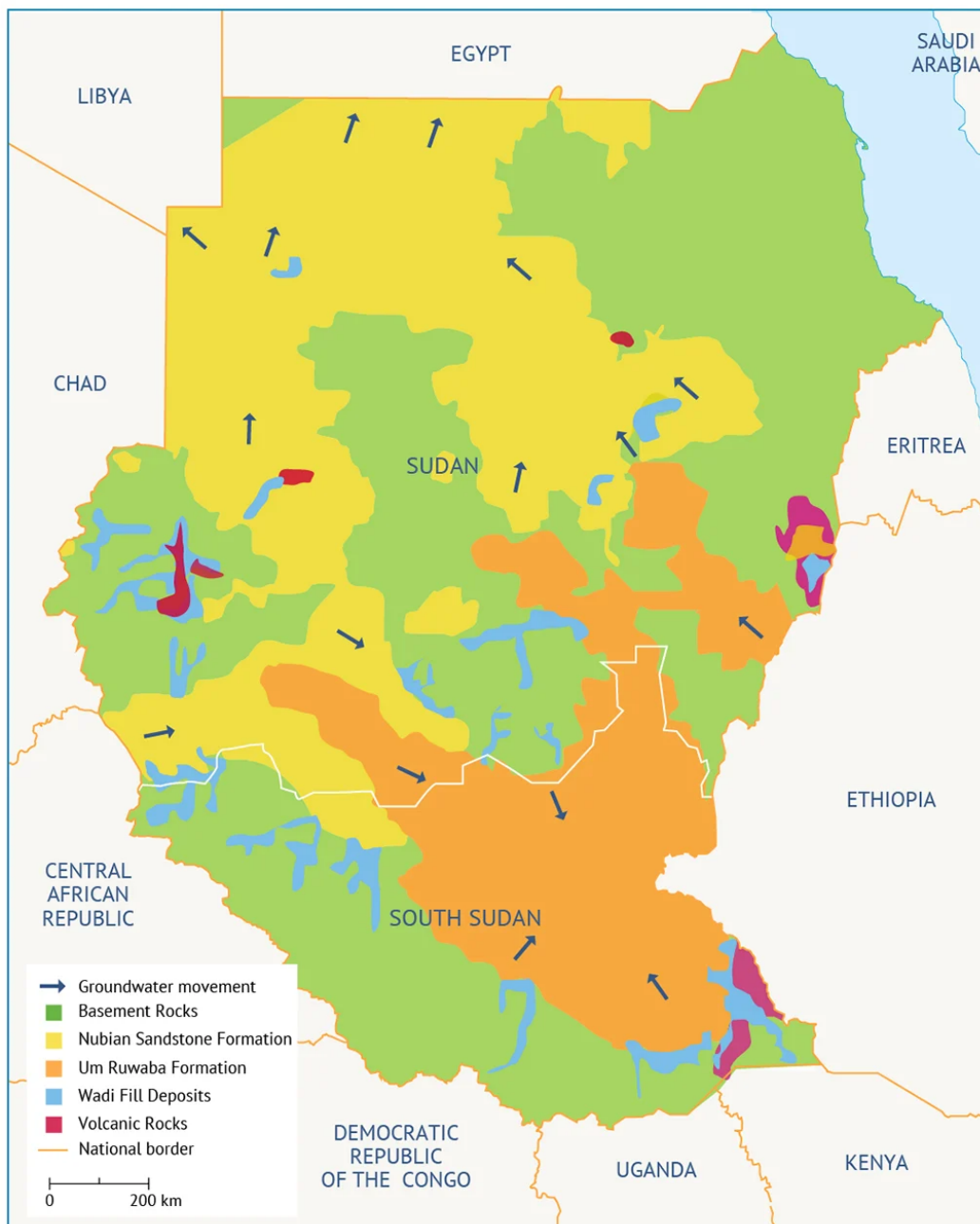
Groundwater is more readily available than other water resources during the long dry season. At least 80% of the population depends almost entirely on groundwater.[\[17\]](#) Away from [the Nile basin](#) and other

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The Nubian Sandstone Aquifer System is shared by Sudan, [Egypt](#) and [Libya](#). It is recharged from the Nile in Sudan (Map 3). With an area of almost 29% of Sudan, the system is the country's most important aquifer. All the major aquifers and their annual recharge and abstractions are shown in Table 1.

Table 1: Annual recharge and abstraction from major aquifers in Sudan.
[19]

Aquifer	Storage (km ³)	Annual recharge (km ³)	Annual abstraction (km ³)
Nubian sandstone	503	1	0.7
Um Ruwaba	60	0.6	0.15
Alluvial deposits	1	0.375	0.16
Total	564	1.975	1.01



Map 5 :Groundwater resources in Sudan and South Sudan. @Fanack water

Non-conventional water resources

In 2020, Sudan had five desalination plants in Port Sudan that daily produced 0.02 MCM. The reuse of wastewater is limited and applied mainly in Khartoum for irrigation in the city's suburbs.[\[20\]](#)

Moreover and prior to the introduction of UNICEF's small bore hand

Kordofan. There are thousands of haffirs of various storage capacities, some reaching thousands of cubic metres.

Total water availability

Sudan’s share of the water from the Nile is 20.5BCM measured at Sennar (Table 2). The non-Nilotic river provides 7BCM, with an additional 4BCM from groundwater. The Food and Agriculture Organization of the United Nations (FAO)[21] estimates the annual water withdrawal per capita to be 1,020m³.

Table 2: Overview of the available water resources in Sudan.[22]

Water resources	Quantity (BCM)	Constraints
Sudan present share from the Nile water agreement (at central Sudan)	20.5	Seasonality, limited storage facilities, expected to be shared with riparian’s.
Water from wadis	5.0 -7.0	High variability in amounts, short duration flows, difficult to monitor or harvest, some shared with neighbors.
Renewable groundwater	4.0	Deep water, high cost of abstraction, remote areas, lack of infrastructure.
Present total	30.0	
Expected from reclamation of swamps	6.0	High capital investment social and environment problems expected.
Total	36	

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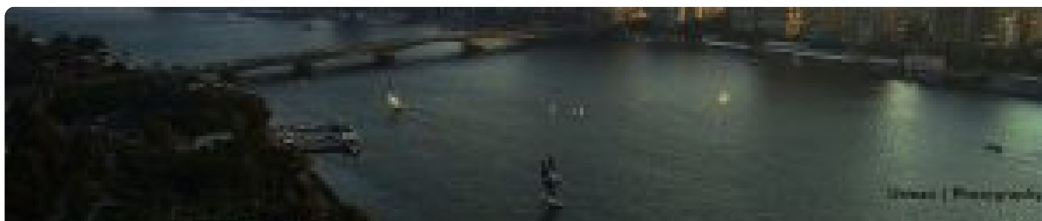
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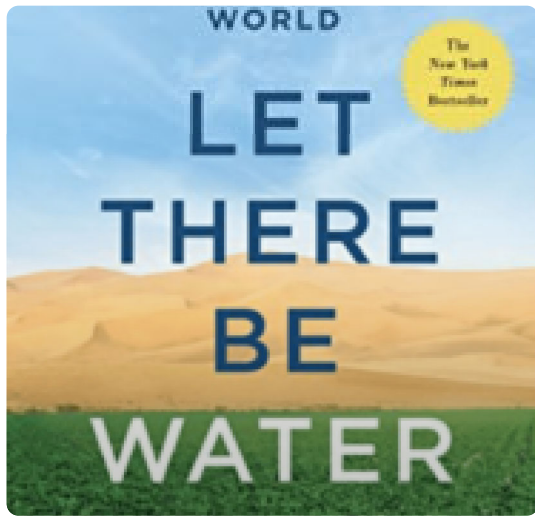
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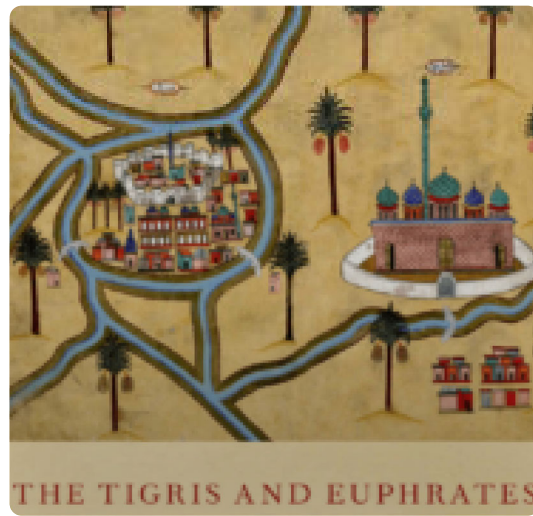
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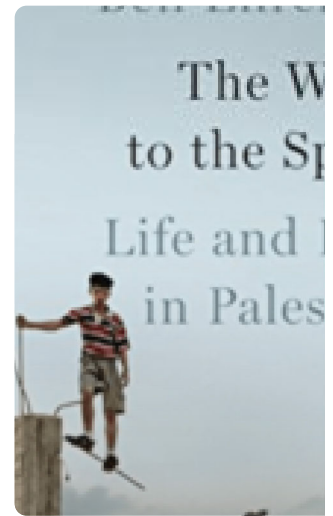
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