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Geography

Advanced

Unit 3: Contested Planet

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Paper Reference

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SECTION B

The following resources relate to Question 6.

WATER CONFLICTS
The Nile Basin

Water for life

The River Nile, the longest in the world, flows north through Africa from its sources in Lake Victoria (White Nile) and Lake Tana (Blue Nile). There are 11 countries through which branches of the Nile flow making it a major **transboundary** river (Figure 1).

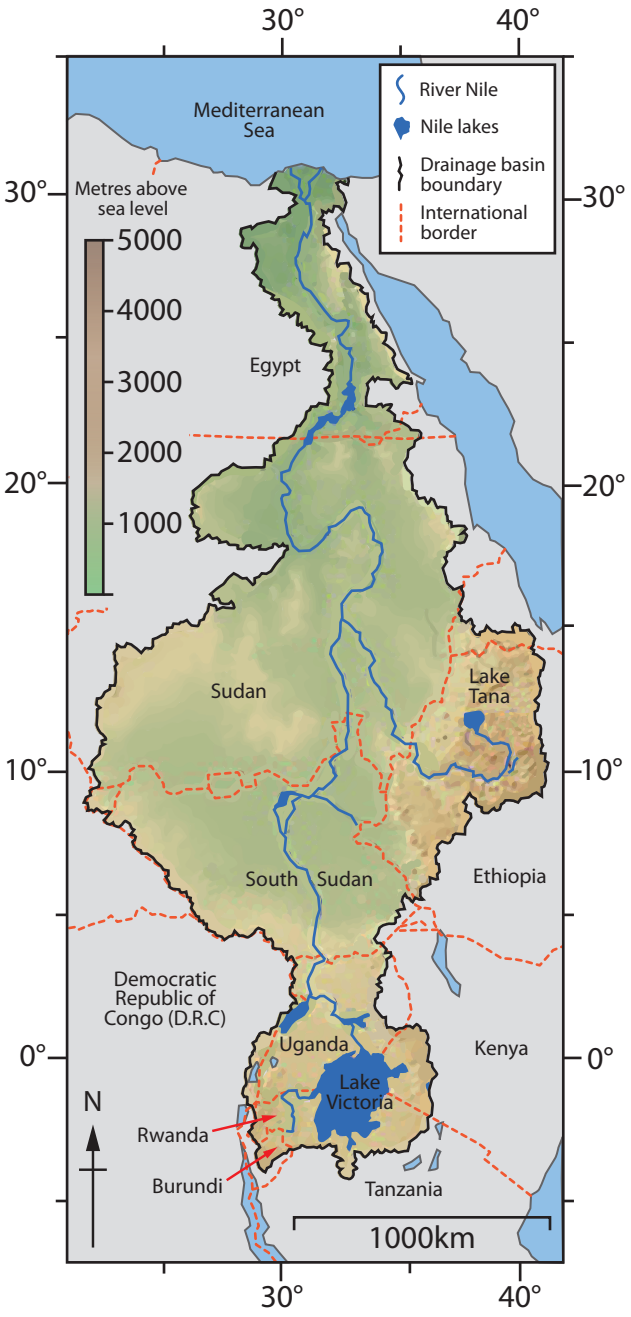

Figure 1: The River Nile drainage basin

The two major White Nile and Blue Nile branches meet in Khartoum and flow north through Sudan and Egypt. The source of the White Nile in Lake Victoria is in an area with an **equatorial** climate, but as the Nile flows north it travels through savanna and desert regions before entering the Mediterranean Sea. Rainfall in countries the river flows through varies considerably (Figure 2).

Country	Percentage (%) of country within the Nile drainage basin	Mean annual rainfall (mm)
Burundi	47.6	1,110
Rwanda	75.5	1,105
Tanzania	8.9	1,015
Kenya	8.0	1,260
D.R.C.	0.9	1,245
Uganda	98.1	1,140
Ethiopia	33.2	1,125
Eritrea	20.4	520
Sudan*	79.0	500
Egypt	32.6	15

Figure 2: Mean annual rainfall and drainage basin area for Nile Basin countries (*including South Sudan)

Nile basin countries are all developing ones. They often rely on **rain-fed** agriculture. **Irrigation** using river, lake or groundwater is also important. Figure 3 shows the proportion of people in the labour force who are farmers for selected countries.

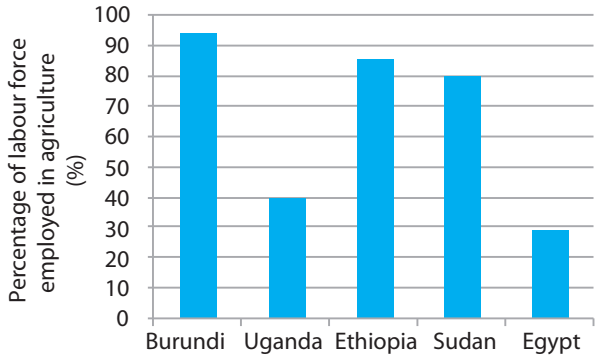

Figure 3: Percentage of the labour force employed in agriculture

The River Nile has been important for millennia. Much of Egypt's tourism industry is based around the river and the **ancient sites** it gives access to. Political instability since the 2011 **Arab Spring** caused tourism arrivals in Egypt to fall from 14.1 million in 2010 to only 10 million in 2015.

Many countries in the region harness the power of the Nile's water, and that of other rivers, to generate electricity from **hydroelectric power** (HEP) as is shown in Figure 4.

Country (2012 data)	HEP capacity (GWh)	Approximate % of total electricity from HEP
Burundi	200	99
D.R.C	7,852	98
Egypt	13,224	12
Ethiopia	6,549	99
Kenya	4,256	76
Rwanda	135	44
Sudan	6,553	73
Tanzania	1,640	30
Uganda	2,425	83

Figure 4: Hydroelectric power in selected Nile Basin countries

Despite the size of the River Nile and the presence in some areas of **aquifers** such as the Nubian Sandstone Aquifer System (a **fossil aquifer** partly in Sudan), many areas in the Nile Basin have low renewable water resources per capita (Figure 5).

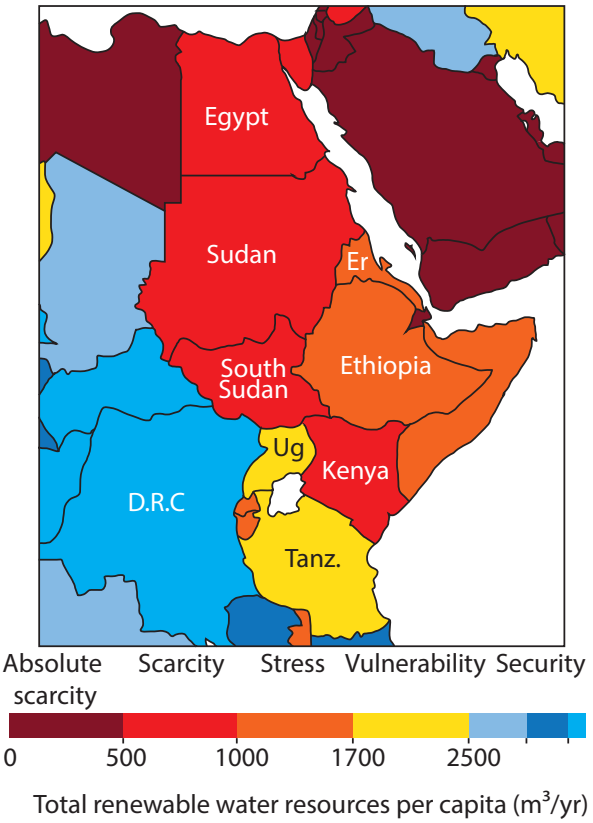

Figure 5: Renewable water resources

Threats

Nile Basin countries have a combined population of over 450 million people with 200 million of them relying directly on the Nile for food and water supply. Figure 6 shows how the population of some countries is expected to grow in the future.

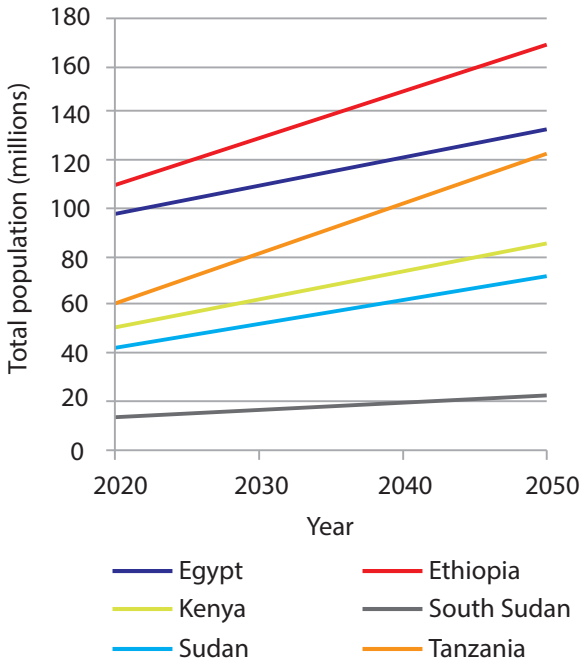

Figure 6: Future populations of six Nile Basin countries

There are question marks over the quantity of water available in the future in the Nile Basin as well as its **quality**.

- Downstream, water in Cairo is heavily polluted by rubbish, industrial waste and sewage spilled into the Nile by Cairo's 10+ million population.
- The rapid growth of Khartoum in Sudan, from a population of less than 500,000 in 1983 to close to 4 million by 2016, risks adding urban and industrial pollution to the Nile upstream.
- Intensive farming and the use of fertilisers risks **eutrophication** of the Nile waters.
- The oil fields of South Sudan and Sudan are a source of frequent oil spills, which pollute groundwater sources and streams, and this oil could eventually pollute the Nile.

Climate change is a potential threat to the water supply of the River Nile and the wider **hydrological cycle** in the region. Rising global temperatures predicted for the 21st century could increase evaporation and evapotranspiration, reducing soil moisture and the availability of surface water stores. Changing rainfall patterns and shifts in climate belts could mean some places get wetter and others drier. There is considerable uncertainty about the future climate in the Nile Basin. Figure 7 shows one projection of drought in the region by 2060 - 2069.

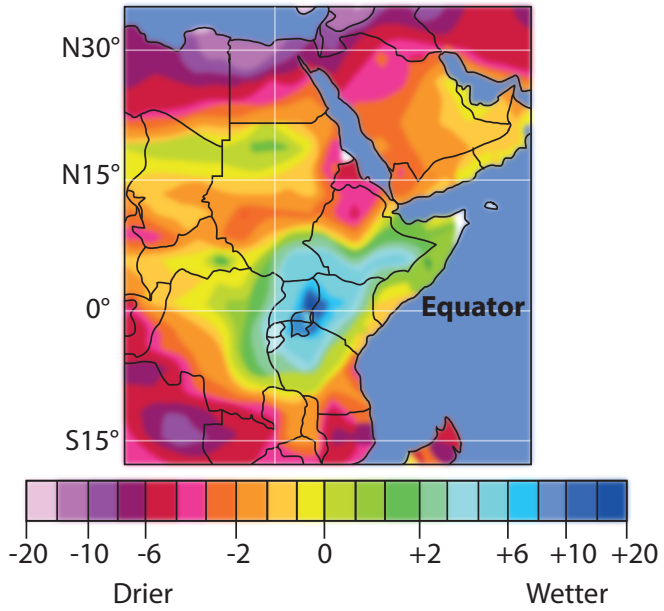

Figure 7: Drought severity predicted for 2060 - 2069 using the Palmer Drought Severity Index

There are numerous dams on the River Nile, and more are planned. Many dams are **multipurpose**:

- storing water for agricultural, domestic and industrial use
- generating HEP
- controlling floods.

Nile Basin developing nations view the river as a potential source of water and energy, both of which are vital to **development**.

Due to the transboundary nature of the River Nile the construction of dams is controversial because of the impacts on river discharge for downstream countries if water is withdrawn upstream. Dam construction risks undermining existing water sharing agreements, making future renegotiation much harder. Figure 8 shows some of the many built and planned dams in the region.

Sennar Dam	Sudan	1925
Owen Falls Dam	Uganda	1954
Roseires Dam	Sudan	1966
Aswan High Dam	Egypt	1970
Merowe Dam	Sudan	2009
Tekezé Dam	Ethiopia	2009
Tana Beles Dam	Ethiopia	2010
Grand Renaissance Dam	Ethiopia	2017
Kajbar, Shereik and Dal dams	Sudan	Planned
Border, Mendaia, Beko Abo, Tekeze II and Karadobi dams	Ethiopia	Planned

Figure 8: Dams on the Nile and its tributaries

Dams allow water to be withdrawn and used for agriculture, domestic use and industry. The large reservoir water surfaces increase evaporation and therefore losses from the river system. Estimates suggest 3 billion cubic metres could be lost to evaporation annually from the Grand Renaissance Dam reservoir, although this is a fraction of the 12 billion lost from Lake Nasser behind the Aswan High Dam. Locally, dams and reservoirs can cause disruption and potentially conflict due to:

- forced relocation of existing populations, often involving human rights abuses
- loss of fertile farmland on river banks
- destruction / flooding of archaeological and culturally important sites
- disruption to ecosystems, such as the loss of wetlands and marshes.

The Nile has a long history of **hydro-politics**, which have made the river system a challenge to manage (Figure 9).

1929	**First Nile Waters Agreement** 48 million cubic metres of the Nile's discharge was allocated to Egypt and 4 billion to Sudan. Only 14% was allocated to other African countries. Egypt had the right to veto any construction on the river e.g. dams.
1959	**Second Nile Waters Agreement** 55.5 billion cubic metres were allocated to Egypt and 18.5 billion to Sudan. There were no other country allocations. The colonial rulers of upstream countries (e.g. Kenya, Uganda) signed the agreement. Ethiopia refused to recognise the legality of the agreement.
1999	**The Nile Basin Initiative is launched** Nine countries aimed to work together to *"achieve sustainable socioeconomic development through the equitable utilisation of, and benefit from, the common Nile Basin water resources".*
2010	**Cooperative Framework Agreement (the 'Entebbe Agreement')** Upstream Ethiopia, Kenya, Uganda, Rwanda, Burundi and Tanzania signed an agreement to work to get access to a greater share of the drainage basin's water. This was opposed by Egypt and Sudan.
Post-2015	**Entebbe Agreement** countries continue to work together, marginalising Egypt (in its view).

Figure 9: Timeline of Nile Basin hydro-politics

Globally, there are numerous examples of water-sharing agreements for transboundary water sources. The **Helsinki Rules on the Uses of the Waters of International Rivers** (1966) is a framework for drawing up an equitable agreement. It was superseded in 2004 by the **Berlin Rules on Water Resources.**

Futures

The future of water in the Nile Basin is uncertain. A new water-sharing agreement between the 11 countries would be a major step forward but this may be unlikely. There are other options for downstream countries which could help manage water supply and demand. These three options, A, B and C are outlined in Figure 10.

A: Desalination

Desalination is an increasingly popular way to increase water supply, by turning seawater into drinkable water by removing salt. Usually this is done using the **reverse osmosis** process in large industrial-scale plants. By 2016, up to 300 million people worldwide relied on desalination for their water supply.

A large desalination plant in Saudi Arabia

Desalination is an **energy intensive** process and this raises both economic cost and environmental impact questions.

Costs have fallen over the last several decades as the process has been refined and made more efficient, with renewable energy providing a potential future power source.

B: Water conservation

There are a range of technologies that can be used to make water 'go further' in both rural and urban areas. In rural areas, **drip irrigation** is a simple way to reduce water losses through evaporation. It can be linked to a formal piped water supply, or simpler supply systems such as **rainwater harvesting** from roofs or small-scale **check dams**.

In urban settings, **greywater recycling** systems can reduce household water use by up to 30%, as water from some functions is reused in others. Greywater can also be recycled for use on crops. **Singapore** is a world leader in water conservation. Urban water conservation may require considerable investment.

Greywater being used to water crops in Ethiopia

C: Privatisation

Historically, water supply systems have been run by governments and state-owned companies with water being considered a 'public good'.

Since the 1990s, water supply systems have been sold off by governments to private companies. This happened first in developed countries such as the UK and France but has since spread to developing countries such as **Bolivia**, the **Philippines** and **Colombia.**

Proponents of privatisation argue that its benefits include:

- long-term investment to improve supply and quality
- reduced corruption and waste, that affects government-owned companies
- incentives to reduce waste, leakage and other losses because these all reduce profits
- incentives to extend water supply systems to more paying customers.

In some cases, water privatisation is supported by **IGOs** such as the IMF and the World Bank.

A cartoon about water privatisation

Figure 10: Three water management options

Views related to water supply in the Nile Basin

View 1

"The Renaissance Dam is merely the latest test of countries' willingness to share water. There may soon be more difficulties. Ethiopia plans to build other dams on the river, which could further affect downstream supply. Sudan has promised foreign investors an abundance of water for irrigation. If Egypt is made to feel at the mercy of its neighbours, it may not have finished rattling its sabre."

The Economist, 2016

View 2

"Egypt, Ethiopia, and Sudan signed an agreement on Tuesday finalising the two firms tasked with carrying out studies on the potential impact of Ethiopia's Grand Renaissance Dam on the flow of the Nile. The leaders of the three countries signed a co-operation deal in Khartoum in March that paved the way for a joint approach to regional water supplies. Cairo and Addis Ababa had previously been locked in a bitter war of words over Ethiopia's $4 billion project."

Reuters, 2016

View 3

"In the past it was one big drought every 10 years, then it came to one drought every five years, and now the trends are showing that it will be one every three to five years. So we are in a crisis alright, that is true. But it's going to be the new norm. So our responses need to appreciate that … there is climate change, and it's going to affect the people that we work with, the communities we serve."

World Vision, 2016

View 4

"Women and girls are more likely to bear the burden of fetching drinking water from outdoor sources. Surveys from 45 developing countries show that in almost two-thirds of households without a drinking water source on the premises, it is women and girls who collect water. In Sub-Saharan Africa, women and girls spend 40 billion hours a year collecting water – the equivalent of a year's worth of labour by the entire workforce in France."

World Economic Forum, 2015

Websites for further research

Economic and social data for the countries within the Nile drainage basin can be found at:

http://data.worldbank.org/

https://www.cia.gov/library/publications/the-world-factbook/

There are a number of websites that focus on water resource management, these include:

https://www.internationalrivers.org/

http://www.unwater.org/topics/en/

Pearson Education Ltd. gratefully acknowledges all following sources used in preparation of this paper:

Section B, Figure 1 - Source from: https://upload.wikimedia.org/wikipedia/commons/2/2b/Nile_watershed_topo.png

Section B, Figure 2 - Source from: http://www.fao.org/docrep/W4347E/w4347e0k.htm

Section B, Figure 7 - Source from: https://stephenleahy.net/2012/11/01/drought-and-new-deserts-by-2060-most-of-mexico-central-america-and-half-of-us/