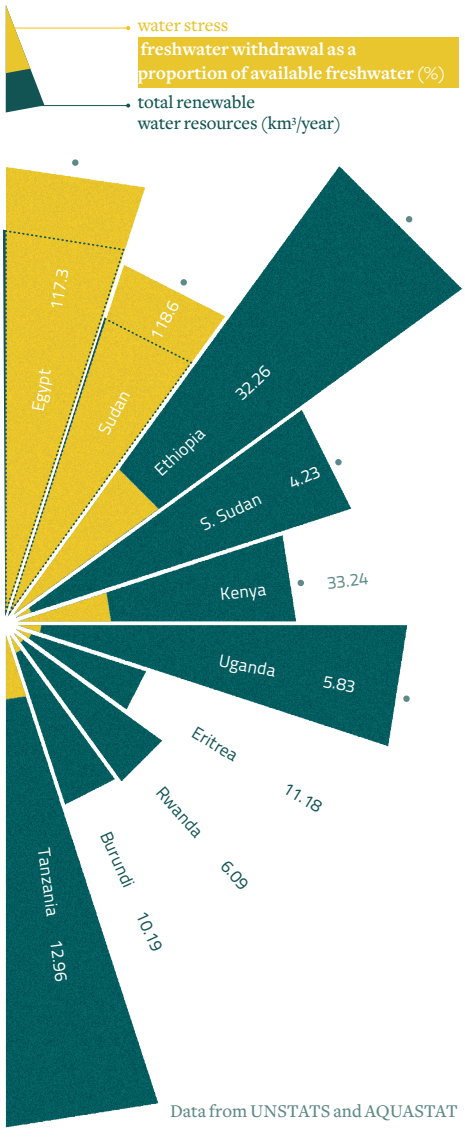
Food and Agriculture Organization of the United Nations

# WaPOR for Water Accounting

Drained by the second longest river in the world, the Nile River's is also among the vastest basins. It extends within and accross the borders of 11 countries, all with economies centered around agriculture. With increasing populations and more pressure on water resources, it is now more important than ever to understand and account for the water that is available.

map key

- Nile River Basin extent
- Political boundaries
- Rivers




Data from UNSTATS and AQUASTAT

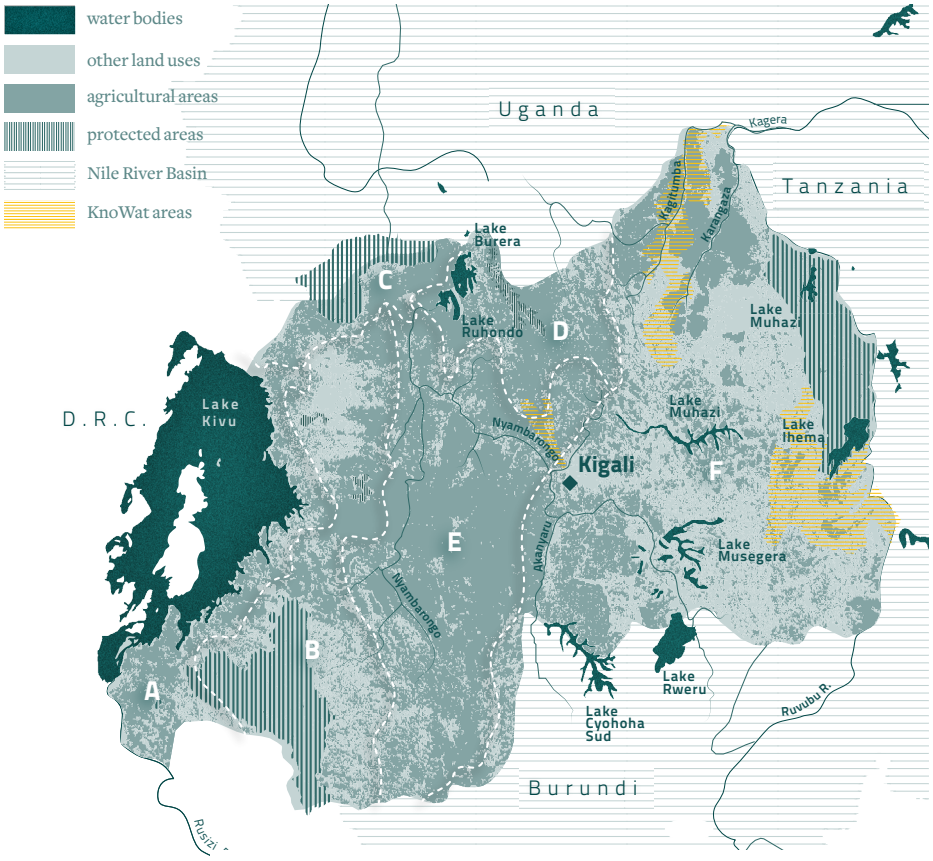
For countries marked with •, the water stress data corresponds to 2017, for the other countries it is as follows: 2013 for Eritrea, 2014 for Rwanda, 2015 for Burundi and 2011 for Tanzania. All TRWR data is from 2017.


Source: Adapted from UN Africa map, 2018.



Final boundary between the Republic of the Sudan and the Republic of South Sudan has not yet been determined.

Though a country like Rwanda isn't water stressed at the national level, at the local level, water availability can differ greatly and be a serious challenge that needs to be understood and quantified to optimize the adaptative response. Water accounting seeks to bring an answer to **where** and **how much** water there is and water auditing is a complementary process that seeks to understand the context of water availability and access.




Boundaries and water bodies adaped fron Natural Earth data. Conforms to United Nations world map.
Protected areas source: IUCN. Land cover : WaPOR

Rwandan agro-ecological zones:

- A Kivu climate
- separation between zones
- B Southern Zaire ridge humid mountain climate
- C Northern dry mountain climate
- D Buberuka highlands
- E temperate zone of the central plateau
- F drier and hotter savanes

Adapted from MINAGRI and Henninger (2013).

Rwanda is a country situated in the Great Lakes region in Central Africa and is composed of a dense hydrographic network and abundant water resources. According to AQUASTAT data, the total freshwater withdrawals account for a little more than 6 percent of the total available freshwater (in 2014) , which means it is far from being a water-stressed country from a withdrawal standpoint. Yet, Rwanda does suffer from localised water scarcity, defined as excess of demand over available supply, particularly when different users compete for limited quantites of the resource.

In fact, the capital of the country, Kigali often experiences water shortages which goes to show that the spatial and temporal distribution of water resources is an important aspect to understand and manage, two dimensions that WaPOR data can help provide insights on. This is crucial for sustainable water governance and management, so that users can get water that responds, in both quantity and quality, to their particular use, when they need it, in an appropriate manner.

While the Northern and Western provinces of the country experience an over-abundance of precipitations causing erosion, flooding and landslides, the Eastern and the Southern provinces are more affected by seasonal droughts.

Without any action, current issues of scarcity are only to gain in amplitude as the population grows putting an increasing amount of pressure on the water resources, especially in urban centers, and on the agricultural land. Agriculture already accounts for 96 percent of water withdrawals making it a central sector for intervention in matters of water management. Yet, 80 percent of agriculture in Rwanda is rainfed. The irrigated area is projected to be expanded in the future as measure to reduce the vulnerability of the agricultural sector to uncertainties posed by precipitations and climatic variability and change.

**Definitions:**

**Water accounting** is the systematic study of the current status and trends in water supply, demand, accessibility and use in domains that have been specified.

**Water auditing** goes one step further than water accounting by placing trends in water supply, demand, accessibility and use in the broader context of governance,institutions, public and private expenditure, legislation and the wider political economy of water of specified domains.

Source: FAO, 2012

To better manage water resources, countries can resort to water accounting and auditing that allow for the creation of an evidence base of data and information. This leads to better understand the spatial and temporal variation of both biophysical and socio-economic dimensions such as water availability and distribution, but also the demand and use patterns of water users. The ultimate goal is for this understanding to inform and lead to better policies and practices in water management and governance.

Water accounting and auditing (WA&A) can happen at different scales and with varying levels of precision and spatial or sectoral disaggregation and stakeholder engagement. WaPOR data was and is being used in three instances of WA&A projects presented in this case study, one at the level of the Nile River basin (Water Accounting +), another at the national level led by the Ministry of Environment and the National Institute of Statistics of Rwanda (Natural Capital Accounts), as well as the KnoWat project that seeks to go a step further and integrate water tenure considerations and bring particular attention to field-level improvements in land and water productivity. In that order, the projects display increasing levels of detail in the analysis, stakeholder engagement and resource mobilization. The more comprehensive the WA&A, the more insights stakeholders have into the current situation and strategies to sustainably cater to the needs of all the water users, making water management and planning a potentially highly participative project. On one end of the spectrum are projects like WA+, a desktop assessment, that have less stakeholder involvement (but shouldn't necessarily), and on the other end is KnoWat, which is problem-focused, demand driven, and builds on continuous engagement with stakeholders at different levels.

**Comprehensive accounting and auditing**

- creating comprehensive water-related info-base;
- more stakeholder involvement;
- finer resolution for evaluating more local trends;
- primary data to fill knowledge gaps.

**Rapid accounting**

- identification of priority problems and trends in water supply or demand access;
- easily accessible quality controlled secondary data;
- generally coarser resolution and larger scale.

**KnoWat**

**Natural Capital Accounts (NCA)**

**Water Accounting +**

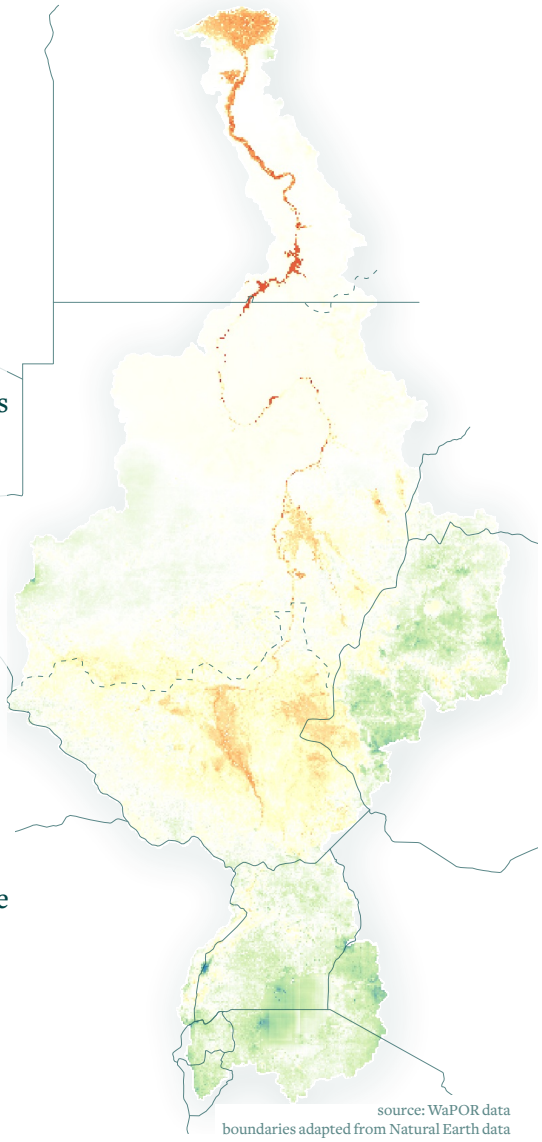
## Water accounting +

In a basin-wide analysis, the project aimed at understanding water availability, water consumption by sectors and safe cap of withdrawals for the agricultural sector in the Nile basin. This is particularly crucial as this basin experienced conflicts in the past and competition over use of water resources is still high in the agenda.

**WaPOR layers used:**

| | |
|---|---|
| Precipitation (P) | (level 1) |
| Interception (I) | (level 2) |
| Land cover classification (LCC) | (level 2) |
| Actual evapotranspiration and interception (AETI) | (level 2) |

*Note: level one data has a resolution of 250m and level 2 data of 100m. Find out more about WaPOR data layers here.*




A parallel can be seen between the countries in this figure that have more negative values of rainfall and AETI difference, and the most water-stressed countries in page 1.

source: WaPOR data
boundaries adapted from Natural Earth data

## Natural Capital Accounts

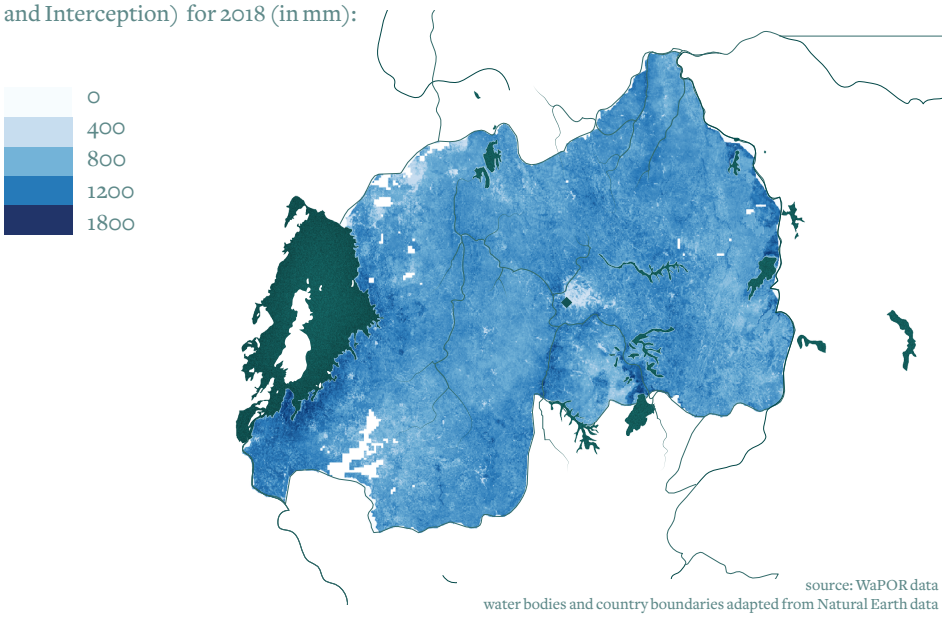
In 2019, Rwanda released its first Natural Capital Accounts (NCA) focusing on water resources and aiming to understand water flows between the economy and the environment (and within each) during the 2012-2015 period.

**WaPOR layers used:**

Actual evapotranspiration and interception (AETI) (level 2: 100m resolution)

WaPOR data was used in the accounting process to calculate actual evapotranspiration ($ET_a$), that is, the amount of water that is "lost" into the atmosphere as a result of transpiration through plant growth and evaporation from soil and water bodies. It is influenced by atmospheric conditions, vegetation status and management. According to the accounting report, the data is strongly considered for use in subsequent water accounts as it provides good quality $ET_a$ data that is available in raster format that allows for the spatial disaggregation of the accounts .

Total yearly Actual ETI (Evapotranspiration and Interception) for 2018 (in mm):




source: WaPOR data
water bodies and country boundaries adapted from Natural Earth data

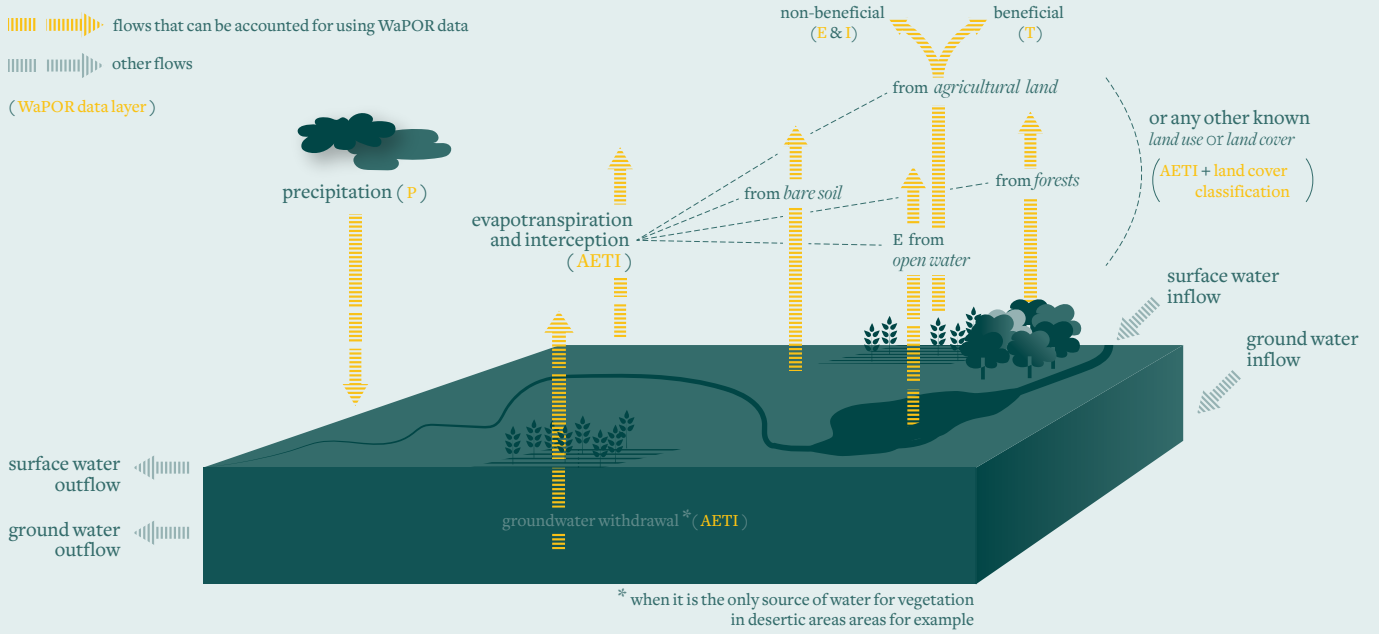
## KnoWat project:

The project "Knowing Water Better" (KnoWat) with pilot programs in Senegal, Rwanda and Sri Lanka, with funding from the German government, aims to improve decision making of water management through better availability, access and use of information on water resources. The project works to expand the WaPOR geospatial database of these three countries. Furthermore, it builds capacities of local stakeholders to conduct water accounting, auditing and tenure assessments, trains technical staff on data collection and use, and evaluates different water use and allocation options.

In Rwanda, the project focuses on reviewing water management and allocation in the Yanze River in central Rwanda, which is one of the main water sources for the city of Kigali, in addition to serving the needs of small-scale farmers, pastoralists and fisherfolk. Furthermore, focus is on the Lower Akagera and Muvumba rivers located in the Eastern part of Rwanda, where government and private investors are developing irrigation. In the three catchments, WaPOR data will be used to update water balance studies through a detailed assessment of evapotranspiration, precipitation, land cover, biomass production and water productivity.

The project is ongoing and this section will be updated as it progresses.

## WaPOR data that can be used for water accounting:




*Note: level one data has a resolution of 250m and level 2 data of 100m. Find out more about WaPOR data layers here.*

## Bibliography:


**FAO.** 2005. *AQUASTAT Country frofile– Rwanda*. Food and Agriculture Organization of the United Nations. Roma, Italia.

**FAO.** 2012. Coping with Water Scarcity: An action framework for agriculture and food security. Report. Rome. http://www.fao.org/3/a-i3015e.pdf

**FAO.** 2017. *AQUASTAT Core Database*. Food and Agriculture Organization of the United Nations. Database accessed on 2020/05/14. http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

**FAO.** 2018. *Water accounting and auditing: A sourcebook*. Food and Agriculture Organization, Rome, Italy. http://www.fao.org/3/a-i5923e.pdf.

**FAO.** 2020. *WaPOR database*. Food and Agriculture Organization of the United Nations. Database accessed on 2020/05/29. https://wapor.apps.fao.org/home/WAPOR_2/1

**Government of Rwanda (NISR, Ministry of Environment).** 2019. *Natural Capital Accounts for Water.* Version 1.0. Kigali, Rwanda.

**Henninger, S.** 2013. Does the global warming modify the local Rwandan climate? *Natural Science*. 05. 124-129. 10.4236/ns.2013.51A019.

**MINAGRI, Hydroplan-SHER (BAD).** 2002. *Schéma directeur d'aménagement des marais, de protection des bassins versants et de la conservation des sols-Phase I*. Report.

**Nile Basin Initiative (NBI).** 2008. *Rapid Baseline Assessment, Rwanda (Efficient Water Use for Agriculture Production Project)*. Report.

**UNEP-WCMC.** 2020. *Protected Area Profile for Rwanda from the World Database of Protected Areas,* May 2020. UNEP-WCMC: Cambridge, UK. Available at: www.protectedplanet.net

**UNSD.** 2020. UNSTAT. In: Global SDG Indicators Database [online]. [Cited 22 May 2020]. https://unstats.un.org/sdgs/indicators/database/


For more information about WaPOR, head to the website:
http://www.fao.org/in-action/remote-sensing-for-water-productivity/en/
or explore the portal: https://wapor.apps.fao.org/home/WAPOR_2/1