Food and Agriculture Organization of the United Nations

Project results: Rwanda

KnoWat: Knowing water better

Towards a more equitable and sustainable access to natural resources to achieve food security

A geospatial database for agricultural water use and productivity

Rwanda is a land-locked country of 26 338 km^2, which borders Uganda, Tanzania, Burundi and the Democratic Republic of the Congo. It is divided into four provinces and the capital city of Kigali, with 30 districts and a total population of nearly 13 million. A temperate tropical climate and two main rainy seasons (February–May; September–December) determine the planting and harvesting cycles. Rainfall varies geographically, with the eastern and southeastern parts of the country receiving less precipitation (700–1 100 mm annually) than the west and northwest (1 300–1 600 mm annually).

The country is rich in water, and agriculture is the backbone of the country's economy, employing around 70 percent of the population. Known as the 'land of a thousand hills', Rwanda is characterized by a dense system of lakes, rivers, marshlands, groundwater and soil water, which are frequently replenished by abundant rainfall.

Rwanda is challenged by climate variability, ranging from changes in rainfall patterns to more extreme weather events. In addition, there is increasing pressure on natural resources (such as water and land) due to population growth, intensification of agriculture, rapid urbanization and industrialization; this has led to competition between water users and a reduction in water quality.

These challenges need to be addressed by Rwanda's water governance institutions to ensure an equitable, sustainable and climate-proof system of water allocation.

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Training in Water Auditing and Governance from 8 to 9 March 2022 in Kigali, Rwanda.

Better data for better decisions

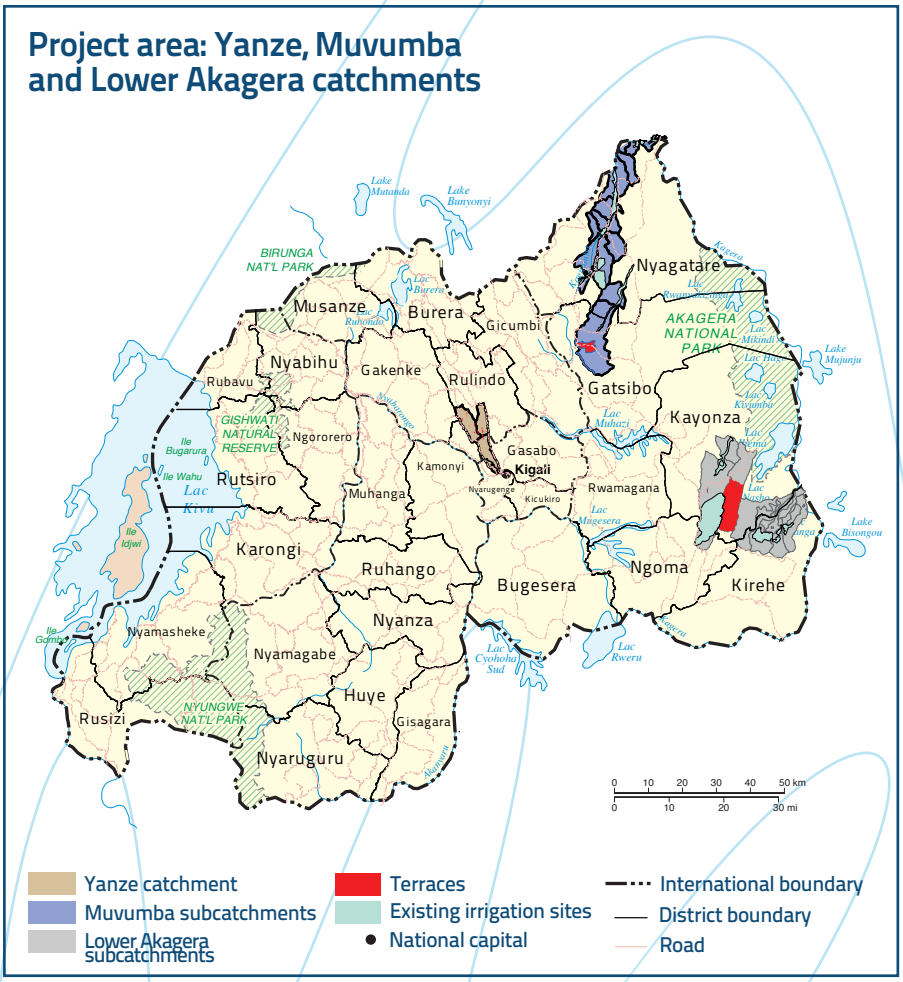
KnoWat established a geospatial database based on the water monitoring tool developed for the Food and Agriculture Organization of the United Nation (FAO)'s Water Productivity through Open-access of Remotely sensed derived data (WaPOR) project.

The database was used to assess agricultural water consumption and water productivity in Rwanda by interpreting satellite images in the Yanze, Muvumba and Lower Akagera catchments.

The database includes eight years of data on the catchments (2015-2022) at 30 metres resolution. Data at 100 metres resolution is available for all of Rwanda. The data are freely available on FAO's WaPOR portal.

Twenty experts from FAO's partner institutions in Rwanda were trained to interpret WaPOR datasets produced for the project, such as water resource assessments and scheme-level information, including analyses of water productivity.

Project area: Yanze, Muvumba and Lower Akagera catchments



Source: United Nations' Department of Field Support, Geospatial Information Section, with added data from the Rwanda Water Resources Boards (RWB).

WATER PRODUCTIVITY

Water Productivity through Open-access of Remotely sensed derived data (WaPOR)

WaPOR is the FAO's portal that monitors water productivity in near-real time through remote sensing, identifies water productivity gaps and proposes solutions to address these gaps.

Water productivity is assessed in a different way for the three spatial levels: level I (continental level - 250 m ground resolution), level II (national and sub-national level - 100 m ground resolution) and level III (irrigation scheme and sub-basin - 30 m ground resolution).

Training on the use of WaPOR from 7 September to 22 October 2021 in Musanze District, Rwanda.

Assessing water productivity

KnoWat in Rwanda. February 2020.
Photo credit: © FAO/Benjamin Kiersch

To demonstrate the application of WaPOR data at the scheme level, the KnoWat project conducted a water productivity assessment in the Nasho irrigation scheme in the Lower Akagera catchment in collaboration with the RWB, the Nasho Cooperative and the Rwanda Agriculture and Animal Resources Development Board (RAB).

The scheme comprises an area of 1 173 hectares irrigated by pivot systems, serving 2 099 smallholder farmers.

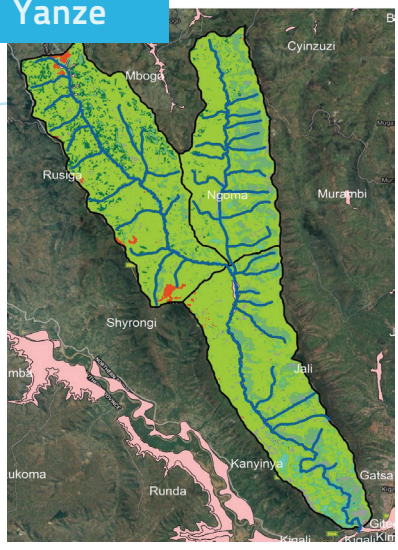
The assessment focused on maize that was cultivated in Season B (February–June) during the period 2016–2021. In the Nasho irrigation scheme, maize has an average yield of 6.5 tonnes per hectare and it is mainly irrigated through centre pivot sprinkler systems. The maximum yield is 10 tonnes per hectare.

The study revealed a high spatial variability in both yield and water productivity throughout the six years under examination. This appears to be due to the varied levels of expertise of farmers working in the scheme and the different agricultural practices applied during the growing season.

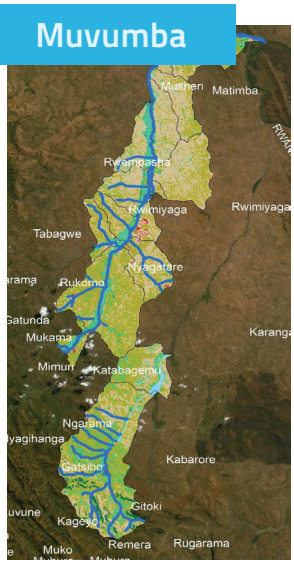
The assessment revealed important information on the performance of the irrigation system, identifying land and water productivity gaps. It also exposed bright spots, i.e. fields where water productivity is exceptionally high, and hot spots, where water productivity is low. Season 2021 experienced higher yields (average 7 tonnes per hectare) and water productivity (2 kilogrammes per m^3) as well as lower spatial variability, probably due to the favourable rainfall and more efficient agricultural practices.

The challenges identified by the assessment included uncertainties in the land cover maps provided by WaPOR, which may have been affected by the high cloud cover of the satellite images during the main growing period, and by the size of the fields, which were often too small (less than 1 hectare) to be detected by remote sensing.

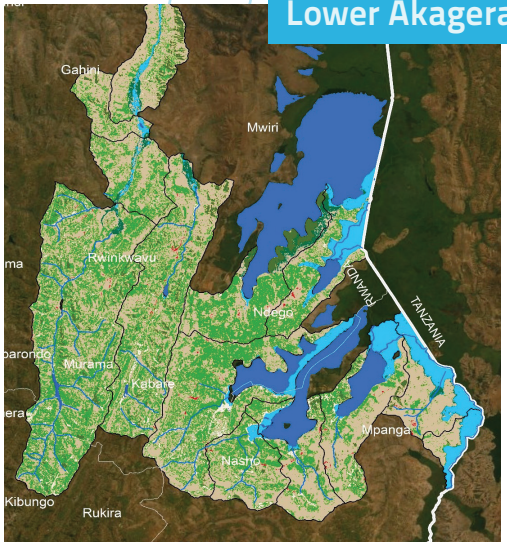
Yanze



Muvumba



Lower Akagera



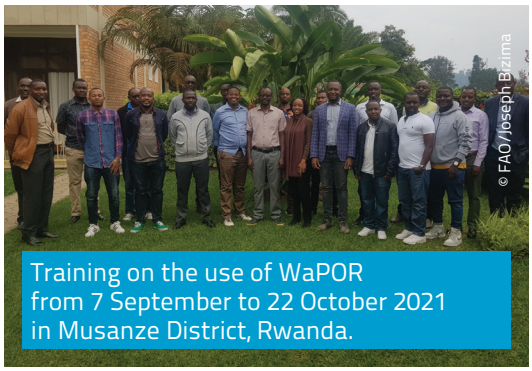
Source: Water Productivity through Open-access of Remotely sensed derived data (WaPOR)

Project testimonials

Jean Damascene Munyeshyaka is a global information systems (GIS) expert, who works on World Bank and Korea International Cooperation Agency (KOICA)-funded projects in the Department of Monitoring Information System (MIS) of the Rwanda Agriculture Board.

In 2021, Jean attended the WaPOR training course conducted by the International Water Management Institute (IWMI) and FAO:

> "WaPOR has a unique and simple way to analyse and display remote sensed data of water productivity. It is now easy for me to analyse maps on water productivity for different agricultural seasons. The benefits of WaPoR are an added advantage within my daily tasks and have significantly reduced the challenges I was experiencing before in analysing maps for irrigation projects. [The] WaPoR application has grown to become a key aspect of my work."



Training on the use of WaPOR from 7 September to 22 October 2021 in Musanze District, Rwanda.

Alsaad Ndayizeye is a river flood control specialist at the Rwanda Water Resources Board.

> "The training series on WaPOR has helped me increase my knowledge on the use of remote sensing in water resources assessment and water balance as well as water productivity assessment. WaPOR is [a] good source of different datasets, especially evapotranspiration which is [a] key component in water resources assessment. WaPOR has been successfully integrated in different water-related studies within RWB, especially for evapotranspiration analysis.
>
> Remote sensing helps in water resources planning and management through analysis of water availability and demand. [The] capacity of national staff still need[s] to be improved for automating water resource assessments based on WaPOR."

Further information

Use the QR code to learn more about the activities implemented in Rwanda.

www.fao.org/in-action/knowat

Expanding the application of remote sensing techniques

WaPOR's remote sensing tool has been used by key institutions in Rwanda, including the Rwanda Water Resources Board (RWB), to support water resources planning and the development of irrigation projects. For example, WaPOR data on evapotranspiration was used as an input to the water balance for the natural capital accounts as well as hydrological assessments of selected watersheds. Remote sensing techniques are also used in the sustainable management of water resources, including runoff and hydrological modelling. In future, they may support flood and watershed management.

Reliable information on water productivity helps farmers to better manage water resources and increase agricultural production. The results of the KnoWat project provide us with important lessons on future applications of WaPOR for water productivity assessments in Rwanda. Additional capacity building and support, particularly on the application of WaPOR in water productivity assessments, could further strengthen the use of WaPOR at national, catchment and irrigation scheme levels.

KnoWat: Knowing water better

Towards fairer and more sustainable access to natural resources for greater food security

Rwanda, Senegal and Sri Lanka (2019–2022)

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All around the world, countries are struggling to adapt their agricultural and food systems to conditions of climate change and to extreme weather events such as long periods of drought or heavy rains. Water scarcity is expected to increase as is competition for water resources among users. Smallholder farmers are particularly vulnerable to changes in water access and availability: a sudden lack of water due to drought can mean lost income and food, threatening their lives and those of their families. For these reasons, major efforts are needed to address the links between water scarcity, food security and livelihoods in our changing climate.

The KnoWat project takes an integrated approach to water resources management that includes water accounting, water productivity, water governance and water tenure assessments. **Water accounting** is the systematic study of current status and future trends in water supply and demand in a given spatial domain. **Water productivity in agriculture** signifies the ratio between yield and the water consumed by a crop. To support water accounting and productivity assessments, the KnoWat project built the capacities of key partners to apply FAO's Water Productivity Open-access Portal (WaPOR). This tool assesses water consumption in agriculture and the water productivity of agricultural production using remote sensing.

Water governance assessment looks at the broad framework of institutions, finance and the political economy. To better understand water governance processes, the project developed and tested a **new methodology to assess water tenure**, the formal and informal arrangements used to access water. The assessment of water tenure aims to understand the different relationships between people and water resources.

Enriching our knowledge around water through accounting, productivity, governance and tenure assessments helps policy and decision-makers to plan and implement **better policies**, with the ultimate goal of ensuring equitable water allocation for **better livelihoods, food security and healthy ecosystems**, even under conditions of growing water scarcity.

Federal Ministry of Food and Agriculture

This project is supported by the **Federal Government of Germany** and implemented by the **Food and Agriculture Organization of the United Nations** (FAO). In Rwanda, the project is implemented in partnership with the **Rwanda Water Resources Board** and the **Rwanda Agriculture and Animal Resources Development Board**. The country activities were implemented in collaboration with **Open Construction and Related Services** (OPRS) and the **International Water Management Institute** (IWMI).

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