



KnoWat: Knowing water better

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

Efficient use of water in agriculture: water productivity using satellite data

Located in western Africa, Senegal is bordered by Mauritania, Mali, Guinea and Guinea-Bissau. It has a population of around 17 million. In rural areas, agriculture plays a major role in supporting the livelihoods of many households.

Senegal has significant water resources, but they are threatened by excessive use, including the overexploitation of groundwater. Insecure land tenure rights complicate subsistence food production. Poverty and food insecurity are significant problems. Equitable access to water resources is a major challenge as competition and conflict between users increase, coupled with a lack of clarity around access rights.

Senegal's climate is marked by extreme weather events such as floods and droughts. This circumstance has been greatly exacerbated by climate change. Water reservoirs often run dry due to intense periods of drought, affecting people's food security and livelihoods.

Efforts are underway to develop corporate and industrial irrigated agriculture especially in the Senegal River Basia area, where there is easy access to Dakar's main urban market and export markets.



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Project area

The KnoWat project focuses on the Senegal River Basin, an area of strategic importance for the irrigated production of rice, vegetables and other food crops.

Due to multiple challenges, such as climate change, population growth and increasing food needs, there have been significant deficits in cereal production, especially rice, in recent years.

To reduce these deficits, the government started to promote irrigation development in the basin in 2003.



Data derived from remote sensing for decision-makers

The KnoWat project created a geospatial database based on remote sensing data gathered through the Food and Agriculture Organization of the United Nation's WaPOR (WATER Productivity through Open-access of Remotely-sensed derived data) tool. The database was used to assess agricultural water consumption and water productivity by interpreting satellite images in the Senegal River Basin.

It includes eight years of data (2015–2022) covering the entire Senegal River Basin (426 139 km²), including parts of Guinea, Mali, Mauritania and Senegal – at a 100 metre resolution, and the Ross Bethio section of the Senegal River Delta (611 km²) at a 30 metre resolution. Data on evapotranspiration, biomass production and land cover for these areas are freely available on FAO's WaPOR portal for the period 2015–2022.

To calibrate land cover data to 30 metres, the project conducted a land cover assessment in the pilot area during three seasons: winter season 2020/2021, cold dry season and hot dry season 2021.



Source: United Nations' Department of Field Support, Geospatial Information Section with added information from Natural Earth, Global Delta Risk and Hydrosheds

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

www.fao.org/in-action/remote-sensing-for-water-productivity



**WATER
PRODUCTIVITY**

Water productivity assessment

To demonstrate the usefulness of the WaPOR portal in areas of scarce water resources, the KnoWat project carried out a crop water productivity assessment for rice cultivation in the Ross Bethio area during the winter season (July–November) and hot dry seasons (February–July) 2015–2021. The assessment calculated crop yield, water productivity and irrigation performance indicators such as water uniformity and adequacy.

The assessment showed that yields in the hot dry season are higher than in the winter months. The yields reported by the WaPOR-based model are generally lower than those reported by the Société d'Aménagement et d'Exploitation des terres du Delta et de la Vallée du fleuve Sénégal (SAED), which manages the irrigation systems in the pilot area.

Water productivity shows a steep gradient from upstream to downstream fields, particularly in the hot season. This shows that there is considerable potential to improve the performance of irrigation, particularly towards the tail end of the system.

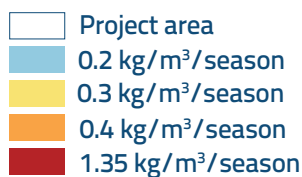
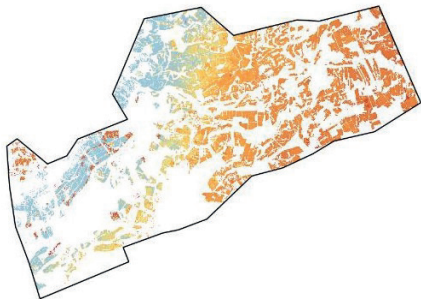
Capacity building to ensure the sustainability of the project's achievements

The KnoWat project trained thirty experts from partner institutions in Senegal to interpret WaPOR data and to use the tool for water resources assessment and system-level applications, including water productivity analysis.

In May 2021, a virtual training session for 15 technical staff of partner institutions was held on the WaPOR and PROGRES databases.

The project also supported the organization of a major capacity building programme from 21 to 24 September 2021 in Saly, Senegal, as part of the joint project "Improving Land and Water Productivity in the Sudano-Sahelian Belt," funded by FAO. The session assisted about twenty national experts to strengthen their capacities in the practical use of the WaPOR tool.

Water productivity in the pilot area Ross Bethio (2019)



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

Further information

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



www.fao.org/in-action/knowat

Expanding the application of remote sensing techniques

Thanks to the KnoWat project, key actors in Senegal now fully recognize the importance of the WaPOR tool for their work, particularly for providing useful evidence for decision-making.

Through the KnoWat project, FAO has signed letters of agreement with public organizations such as SAED and the Directorate of Management and Planning of Water Resources (DGPRES), as well as with civil society organizations, such as the National Council for Consultation and Cooperation of Rural People (CNCR), in order to foster synergy of action. In the future, for example, WaPOR can be used in water balance studies in the Senegal River Basin and elsewhere, to support water accounting, where available data are limited. This will further inform rational water resources planning and management.

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

Rwanda, Senegal and Sri Lanka (2019–2022)

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.



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Federal Ministry
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National activities were implemented in collaboration with the National Council for Consultation and Cooperation of Rural People (CNCR), the Directorate of Management and Planning of Water Resources (DGPRE) and the *Société d'Aménagement et d'Exploitation des terres du Delta et de la Vallée du fleuve Sénégal (SAED)*.



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