

Food and Agriculture Organization of the United Nations

KnoWat: Knowing water better

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

KnoWat project results and activities Rwanda, Senegal and Sri Lanka



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KnoWat project results and activities Rwanda, Senegal and Sri Lanka

Around the world, countries struggle to adapt agricultural and food systems to conditions of water scarcity, climate change and increased competition between resource users. These struggles are only expected to increase. Smallholder farmers are particularly vulnerable to changes in water access and availability because it can mean a sudden loss of income and food.

A greater focus on water accounting and water governance is crucial for addressing water scarcity in a changing climate to ensure food and water security for all. Our capacity to manage and use water resources efficiently and equitably requires us to understand the quantity and quality of water that is available and the rules that govern access to water.

In response to these challenges, a project led by the Food and Agriculture Organization of the United Nations (FAO) – **"Knowing water better: towards a more equitable and sustainable access to natural resources to achieve food security**" (KnoWat) – has built stronger water governance processes in Rwanda, Senegal and Sri Lanka.

The project has strengthened national capacities in water accounting and water productivity in agriculture, using the latest remote sensing technologies and training hundreds of water experts. KnoWat has developed and tested a methodology for assessing water tenure to shed light on the rules and regulations governing access and allocation of water resources. This information is crucial for improving water use, ensuring the equitable allocation of water resources and increasing the resilience of societies to climate change.

The KnoWat project was implemented by FAO in close cooperation with partners at global, country and local levels, and funded by the Federal Ministry of Food and Agriculture of Germany (BMEL).

This short publication summarizes the key accomplishments of the KnoWat project. It is hoped that the project will improve our understanding of water and will strengthen the institutions and people responsible for managing a resource that is critical to the livelihoods and food security of all people and a foundation of natural ecosystems.



Contents

Preface	iii
Country descriptions	
Rwanda	2
Senegal	4
Sri Lanka	6
Project results	
Geospatial database for agricultural water use and productivity	10
Water accounting and auditing	14
Assessing water tenure for food security, equity and climate adaptation	16
Local water governance	20
Water users and uses assessment	22
Stories from the field	
Harnessing source of life in Rwanda	26
Senegal: Poems and a project for peace	30
Reaping the fruits of data in the paddy in Sri Lanka	33
Information resources	37



Country descriptions

Rwanda

Rwanda is a land-locked country of 26 338 km², which borders Uganda, the United Republic of 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.

The country has a temperate tropical climate and two main rainy seasons (February–May; September–December) that determine planting and harvesting cycles. Rainfall varies geographically, with the East and Southeast receiving less precipitation (700–1100 mm annually) than the west and northwest (1300–1600 mm annually).

Rwanda is a water-rich country, and the agriculture is the backbone of the country's economy: it employs around 70 percent of the population. The populated "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 rainfalls.

Rwanda is challenged by climate variability, from changes in rainfall patterns to more extreme weather events. In addition, there is an increase pressure on natural resources (such as water and land) due to population growth, intensification of agriculture, rapid urbanization and industrialization, leading to intensified competition between water users and 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.

Agriculture contributes over **30%** GDP

and employs around 70% of the population



In Rwanda, the project was implemented in partnership with the Rwanda Water Resources Board (RWB) and the Rwanda Agriculture and Animal Resources Development Board (RAB).

Project area

The Yanze river in central Rwanda is one of the main water sources for Kigali, in addition to serving the needs of small-scale farmers, pastoralists and fisher folk. The catchment is characterized by a variety of water users, including: vegetable and fruit production in the valley bottoms, maize and potato production on the hillsides, small scale farmers, coffee washing stations, water treatment plants, mineral extraction sites and small scale irrigation.

The Lower Akagera and Muvumba rivers are located in the Eastern part of Rwanda. Their catchments are characterized by a wide range of irrigation schemes and cattle farms which depend on sufficient surface water. The two catchments suffer from severe precipitation-deficit and/or frequent, severe water shortage particularly in the dry season. Irrigation development has taken place by government and private investors with a view towards improving access to water for all, as well as food security.



Rwanda: Yanze, Muvumba and Lower Akagera catchments

Source: United Nations Geospatial. 2020. Map geodata [shapefiles]. New York, USA, United Nations, modified by the author. Catchment data from Rwanda Water Resources Board (RWB).

Senegal

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.

KnoWat field mission, October 2019. © FAO/Lamine Samaké In Senegal, the project was implemented in collaboration with the Ministry of Agriculture and Rural Equipment, the Ministry of Water and Sanitation and producer organizations.

The 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).

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.





Source: United Nations Geospatial. 2020. Map geodata [shapefiles]. New York, USA, United Nations, modified by the author. Lakes and rivers data from from Natural Earth. Catchment data from Global Delta Risk and Hydrosheds.

Sri Lanka

Sri Lanka is an island country in the Indian Ocean with a land area of 65 610 km² and a population of 21.6 million. It has a network of approximately 103 principal rivers and tributaries, most of which originate in the central and southern parts of the country.

There are three climatic zones in Sri Lanka: the dry zone (annual rainfall less than 1 750 mm), the intermediate zone (annual rainfall 1 750–2 500 mm) and the wet zone (annual rainfall 2 500–4 500 mm). The only source of water is direct rainfall. The biggest user of water is agriculture.

Agriculture contributed around eight percent to national GDP in 2020. Rice is the most important crop, producing 4.1 million tonnes in 2019–2020, enough to feed the entire population of the country. Paddy is grown all over the country, mainly during two monsoon seasons, the Maha season from September to March and the Yala season from April to September. Rice contributes to 1.8 percent of country's GDP and 1.8 million families are engaged in its production. About 983 550 hectares are under paddy, 43 percent of all agriculture lands.

According to the Climate Risk Index 2021, Sri Lanka is the thirtieth most climate-vulnerable country in the world. The country is highly susceptible to extreme weather events such as prolonged droughts.

Due to population growth, economic growth and industry-led deterioration of water quality, the competition for water and water scarcity have increased in recent years.





In Sri Lanka, the project was implemented in collaboration with the Department of Irrigation. The country activities were implemented in collaboration with the International Water Management Institute (IWMI), the Post Graduate Institute of Agriculture of the University of Peradeniya and E-leaf.

Project area: Malwathu Oya Catchment

The Malwathu Oya basin is the second largest river basin in Sri Lanka (3 284 km²) and one of the major agricultural areas in the country.

The KnoWat project area, the Malwathu Oya's southern catchment, extends over 77 950 hectares. The population in the area has been estimated at 204 775. Agriculture, and especially rice farming, is the predominant household livelihood



Source: United Nations Geospatial. 2020. Map geodata [shapefiles]. New York, USA, United Nations, modified by the author. Lakes and rivers data from Natural Earth Data and catchment data from Hydrosheds.



Project results and activities

Geospatial database for agricultural water use and productivity: Better data for better decisions

Developed by FAO, the Water Productivity through Open-access of Remotely-sensed derived data (WaPOR) tool monitors water productivity in near-real time through remote sensing, identifies water productivity gaps and proposes solutions to address these gaps.

The database was used to assess agricultural water consumption and water productivity in Rwanda, Senegal and Sri Lanka by interpreting satellite images in the different project areas.

The data are freely available on FAO's WaPOR portal. Data at 100 metres resolution is available for the three countries, and for the entire Senegal River basin, also covering parts of Guinea, Mali and Mauretania (426 139 km²).

WaPOR also includes specific zones at 30 metres resolution, for the period 2015-2022: the Yanze, Muvumba and Lower Akagera catchments in Rwanda (1 285 km²), the Ross Bethio section of the Senegal River Delta (611 km²), and the Southern Malwathu Oya Catchment in Sri Lanka (779 km²).

Sri Lanka is the first Asian country to have a WaPOR database. A comprehensive water resources assessment of Sri Lanka and Malwathu river basin were carried out to acquire key data and information on water accounting, governance and water productivity.

Sri Lanka is the first Asian country to have a WaPOR database

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





KnoWat trainings on WaPOR. © FAO/Thushara Ranasinghe

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

The KnoWat project trained several experts from partner institutions in Rwanda, Senegal and Sri Lanka to interpret WaPOR data and use the tool for water resource assessment and system-level applications.

In Senegal, thirty experts from partner institutions were trained and, in May 2021, a further virtual training session for 15 technical staff was held on the WaPOR and PROGRES databases. The project also supported the organization of a major capacity building programme in September 2021 in Saly, Senegal, as part of the joint project "Improving Land and Water Productivity in the Sudano-Sahelian Belt," funded by FAO, training twenty national experts.

In Rwanda and Sri Lanka, twenty and thirty experts were trained, respectively. The capacity building activities were organized in cooperation with the International Water Management Institute (IWMI).

KnoWat built capacities on the use of WaPOR in key partner institutions, including: in Rwanda, RWB and RAB; in Senegal, DGPRE and SAED; in Sri Lanka, the Irrigation Department, the Department of Agrarian Development, the Department of Land Use Policy Planning, the Department of Census and Statistics and the University of Peradeniya. These partners now have the tools to use WaPOR to support water resources planning, management, as well as development of irrigation projects.

Project partners in Sri Lanka are currently studying the application of WaPOR for the System for Environmental Economic Accounting for Water (SEEA-W) as well as for monitoring Sustainable Development Goal Indicator 6.4.2 on water stress.

In the future, WaPOR could be used in water balance studies to support water accounting, where available data are limited. Farmers will benefit from getting reliable information on water productivity on their farms leading to enhanced water resource management and increased production.



Further information

Use the QR code to learn more about the project results and activities.

www.fao.org/in-action/knowat

"Rwanda's rapid population growth and industrial development as well as the implementation of the National Strategy for Transformation (NST) are likely to increase the demand for water. Based on current trends, the level of water scarcity will increase.

For this reason, it is important for the central and local governments to have accurate data on the various users of water, water uses and sources, and to be able to monitor the extent to which water users are operating with water abstraction permits. Appropriate decisions on water use management require consistent, comprehensive and reliable water use data."

Alsaad Ndayizeye, River Flood Control Specialist at the Rwanda Water Resources Board (RWB)

Crop water productivity assessment

To demonstrate the usefulness of WaPOR in areas of scare water resources, the KnoWat project carried out a crop water productivity assessment in the three countries.

In Senegal, the crop water productivity assessment analyzed the rice cultivation in the Ross Bethio project area during the winter season (July–November) and hot dry seasons (February–July) in the period 2015–2021.

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 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.

In Rwanda, the water productivity assessment was performed in the Nasho irrigation scheme in the Lower Akagera catchment in collaboration with RWB, RAB and the Nasho Cooperative.

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 m³) 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.

Water productivity in Ross Bethio project area (2019)



Source: FAO. 2022. Water Productivity through Open-access of Remotely sensed derived data. In: FAO. Cited 13 December 2022. https://wapor.apps.fao.org/ Map conforms with UN Geospatial. 2023. Map of Senegal. Cited on 17 May 2023. New York, United States of America. https://www.un.org/geospatial/content/senegal-0

Nachaduwa irrigation scheme: Paddy rice yield, Maha season, 2015-2022



Source: FAO. 2022. Water Productivity through Open-access of Remotely sensed derived data (WaPOR). In: FAO. Cited 16 December 2022. https://wapor.apps.fao.org/home/WAPOR_2/Map conforms with UN Geospatial. 2023. Map of Sri Lanka. Cited on 17 May 2023. New York, United States of America. https://www.un.org/geospatial/content/sri-lanka-0

The Malwathu Ova southern catchment is one of Sri Lanka's most important agricultural zones. The catchment area is prone to extreme weather events due to climate change. These include severe water scarcity and floods, which challenge farmers' work and lives. Inefficient water use in agriculture, particularly in paddy, and poor irrigation infrastructure exacerbate the situation.

The area covered by WaPOR extends over 779 km² and includes the fields of more than 200 000 farmers. The water productivity assessment only considered paddy rice cultivation, since this consumes the most water through irrigation.

The water productivity assessment analysed rice yields in the project area during the Maha monsoon season (1 October–30 March) between 2015 and 2022. Yields of paddy rice ranged from 3.8 to 4.8 tonnes per hectare. The highest yield was achieved in 2017–2018. Yields are lower here than in other districts in Sri Lanka, but are around the global average of irrigated rice yield (4.5 tonnes per hectare).

The project assessed irrigation performance indicators to discover the underlying causes of low water productivity of paddy in certain zones of the pilot area. The assessment revealed that irrigation is neither adequate nor uniform across the basin. Both land and crop water productivity of paddy rice cultivated during the Maha season in Malwathu the Ova southern catchment had a high spatial and temporal variability.

These findings can be used by irrigation experts to identify hot spots and bright spots increase the water productivity in the Malwathu Oya basin.

The assessment also analysed the yield assessment in the Nachaduwa irrigation area. In this area, irrigated crop yield reaches more than 6 tonnes per hectare, while farmers in the rest of the catchment produce less, between 2 and 5 tonnes per hectare. It would be interesting to study the reasons for the higher yields in Nachaduwa. Do farmers there apply good practices that farmers in other areas could benefit from?

The assessment identified a number of challenges, including uncertainties in the land cover maps provided by WaPOR, which may have been affected by the high cloud cover of satellite images during the main growing period. In some areas, the fields were often too small (less than 1 hectare) to be detected by remote sensing at 30 metres resolution. Trustworthy local data on crop cover and crop calendar are needed to ensure reliable irrigation performance assessments. WaPOR works best on large fields with a uniform crop cover and calendar; such was the case in the Nachaduwa irrigation scheme.

The application of WaPOR for water productivity and irrigation performance assessment should continue to improve, thanks to ongoing research by university students supported by the KnoWat project in collaboration with the International Water Management Institute (IWMI). 'The **WaPOR** database is very helpful in the tasks performed by the Irrigation Department for water resources planning. After assessing the water availability and the water use efficiency for better water management, we can plan better our actions, especially in the dry zone of Sri Lanka, where almost all the major, medium irrigation schemes are situated."

Engineer Medhani A. Jayakody, Chief Engineer of the Water Resources Planning Branch, Irrigation Department of Sri Lanka

Water accounting and auditing in Sri Lanka

Water accounting and auditing are an essential aspect of managing water resources. Water accounting is the systematic examination of status and trends in the availability, demand, accessibility and usage of water. Water auditing puts trends in water supply, demand, accessibility, and usage into a broader framework of governance, institutions, public and private expenditure, law and the political economy of water. When combined, water accounting and auditing facilitate policy development and decision-making.

The water accounting study focused on ten subwatersheds of the Malwathu Oya catchment over four seasons. In each case, water balances were calculated with inputs from the WaPOR database, based on the Soil and Water Assessment Tool (SWOT), which is commonly used for hydrological studies by the Irrigation Department of Sri Lanka.

These water balances were compared with observed hydrological data. The study showed that the flows based on the SWOT and WaPOR data were between 4 and 13 percent higher than the observed flows. It concluded that the model replicates the situation on the ground quite well and can be used in future water balance studies.

The water auditing study focused on three case studies in areas where there is an issue with water management:

- Water sharing between agricultural and domestic uses and the issues of unavailability of water from a tank in Thuruwila. The auditing study discovered that enhancing collaboration between area officials and the farmers could help solve issues related to water sharing by drawing on the practical knowledge of the farmers.
- 2. The Nuwara Wewa feeder canal and the issue of illegal use of water. In this case, irrigation officials believe that the illegally-irrigated lands should be legalized because siphoning is difficult to control.
- 3. Water management in areas of low water productivity in the Nachchaduwa irrigation scheme. The analysis revealed inadequate maintenance and cleaning of the canal, which caused flooding and, as a result, low water productivity. In addition to improving the canal system, the establishment of better facilities for accessing and using the infrastructure should be considered.

The results of the water accounting and auditing studies were validated with stakeholders at local and national levels. The information can underpin better decisions on water management in the future.

Capacity building

In cooperation with the International Water Management Institute (IWMI), the KnoWat project trained 30 experts from the Irrigation Department of Sri Lanka and other partners in water accounting and auditing methodologies through a combined on-site and remote training programme.

In cooperation with the University of Peradinya, students and university staff received training in WaPOR-based water accounting and productivity assessments. WaPOR-based assessments have now been incorporated into the curricula of hydrology and agronomy students.



Assessing water tenure for food security, equity and climate adaptation

Water tenure can be defined as "the relationship, whether legally or customarily defined, between people, as individuals or groups, with respect to water resources" [1]. Water tenure determines how people obtain rights to water resources, including the right to access, impound, use and manage water, gain access to information and participate in decisions on water resources management.

To ensure equitable distribution to all legitimate rights holders and to protect natural ecosystems, it is important that existing water tenure arrangements are coherent and all legitimate tenure rights are recognized by national legislation.

Water tenure arrangements can be very complex and vary considerably, including within the same country, influenced by local and social practices, traditions and status, geography, environment and livelihood practices. Different water tenure arrangements may coexist and/or overlap in the same region and water tenure holders may belong to more than one water tenure arrangement.

[1] Hodgson, S. 2016. Exploring the Concept of Water Tenure. FAO Land and Water Discussion Paper 10.

The assessment methodology

The KnoWat project developed a water tenure assessment methodology to identify and analyse the diversity of water tenure arrangements that may exist within a catchment or community. The methodology includes desk research and field data collection as well as capacity building and consultations with decision-makers, national stakeholders and local people that depend on water for their livelihoods. The assessment is carried out by a multidisciplinary team, which includes legal and sociological experts.

It allows the identification and the analysis of water tenure arrangements deriving from different sources, including formal, customary, traditional and indigenous systems. Formal law, often described in terms of 'water rights,' includes permits, licenses, small-scale so-called 'free uses,' concessions, contracts, membership in water users' associations and legal powers conferred on public bodies. Local communities and indigenous peoples that exercise self-governance over natural resources may apply their own rules to the allocation, management, use and protection of water resources. Communities often share resources based on social, cultural or religious norms, some of which may be recognized in formal law.



Watch the video: Water tenure, building equity and resilience to leave no one behind



Assessment methodology

01 Preparation

02 Scoping

03 Research

04 Analysis

05 Validation

06 Reporting

The assessment methodology follows a six-step approach (see figure) to categorize water tenure arrangements and determine their perceived security. It also permits the analysis of governance institutions and the identification of potential conflicts and their resolution through the application and revision of legal frameworks and local practices.

The methodology allows comparisons between countries and between different regions in the same country while highlighting the specificities of each study area. The analysis provided by the assessment assists policymakers to define and safeguard the rights of all tenure holders and to determine how to safeguard water resources for users, while ensuring food security, livelihoods and the integrity of natural ecosystems.

Rwanda: Muvumba catchment and Yanze subcatchment

In **Rwanda**, the assessment was carried out in the Muvumba catchment area in Nyagatare District and the Yanze subcatchment area in Rulindo District. The key recommendations for the governance of water tenure in Rwanda include:

- Taking into consideration the mandate of the newly created National Consultative Committee on Water (NCCW), create (or embed within the NCCW) a technical, inter-agency working group. The group should focus on key areas of legislative reform under the current water law, with reference to the findings of this water tenure assessment.
- Finalize the preparation of ministerial orders on water use permits and water use fees to create a comprehensive regulatory package that can be rapidly implemented once any necessary revisions to the law are enacted.
 If legislative reform should prove to be untenable, key issues highlighted in the report could be included in a ministerial order as an alternative.
- Assess capacities and needs to enable the rapid, systematic and comprehensive implementation of the permitting regime as well as possible funding sources and a detailed implementation plan.
- Finalize a water fee structure based on water use category so that high impact users pay according to use levels and increase the financial capacity of the water service institutions.

Senegal: Podor and Saint-Louis

The water tenure assessment in the **Senegal River Basin** focused on institutional and legal frameworks as well as customary water governance. Three field missions took place in the research areas in Podor and the Gorom-Lampsar axis in Saint-Louis. The results of the assessment were validated at local and national levels by key stakeholders.

The assessment found that:

- Formal law and customary provisions governing tenure relationships coexist in the research area.
- Some local water users are unaware of water laws and regulations, and some local authorities lack the capacity to implement and enforce water legislation.
- Current legislation is not adapted to new challenges, such as the intensification of agribusiness, climate change and population growth, all of which are putting increased pressure on water use.
- Current legislation around water resources management does not take into account local customs and practices, nor does it consider the circumstances of women, young people and marginalized groups. This leads to unequal access to water resources for some people, negatively affecting their livelihoods, food security and sanitation.
- The large number of water stakeholders and the lack of synergy between them create major constraints for integrated water management.
- Users have little involvement in water policy development and management.
- There is no operational framework for dialogue between actors.

Based on these findings, it was recommended that decision-makers take steps to raise awareness among water users of existing water legislation. In addition, water legislation should be reconciled with the local customs and good practices of water users. A further recommendation was to strengthen the participation of water users in decision-making and reforming the water sector and to include access to water as a human right in the Senegalese constitution. Above all, measures should be taken to reduce conflicts between water users and to ensure availability and more equitable access to water resources for everyone.

Stakeholders from government and civil society and research, technical and financial partners have proposed that the water tenure assessment results be disseminated widely. The results should also inform the process of revising Senegal's new water law.





Sri Lanka: Malwathu Oya southern catchment

The KnoWat assessment identified and compared various water tenure arrangements in the Malwathu Oya southern catchment in Sri Lanka, as well as at the national level, and highlighted the threats, issues and conflicts involved. Currently, 52 legislations govern Sri Lanka's overall water sector. 40 state agencies housed in various line ministries are involved in administering water resources and addressing their challenges.

The key recommendations include:

• Improve the management of irrigation water, particularly monitoring the provision of irrigation water to calculate the exact and adequate amount of water needed for paddy. Irrigation is the main water user.

 Bring all water sector institutions under one umbrella to simplify collective and inclusive planning, reduce costs and speed up decision-making in the water sector.

• Establish an overarching policy to govern the water sector and an appropriate governance structure for basin management.

• Implement existing rules and regulations to control illegal and unregulated water use and reduce water-related conflicts between water users and tenure regimes.

• Streamline water sector laws and have a separate water law for the country. Most water laws are out of date and responsibilities are spread out among large number of agencies.

• Review the provincial administration layer created by the 13th Amendment of the Constitution, taking into account the issues between central and provincial government agencies.

• Improve coordination among existing water sector agencies by implementing common systems and procedures and encouraging participatory water sector planning.

• The role of project management committees (PMCs) in water tenure governance and water management should be further strengthened. Membership of the PMCs should include all water sector stakeholders.

• At the national level, strengthen the water management panel for science-based decision-making and participatory water management mechanisms.

• Establish free sharing of data and information among water users and institutions to enable better decision-making.

• Introduce modern water tenure arrangements where possible to minimize water tenure insecurity.



Senegal: Strengthening local water governance

To strengthen the capacities of local actors in water tenure governance, the National Council for Consultation and Cooperation of Rural People (CNCR), with support from the KnoWat project, trained five local facilitators in water governance concepts and instruments, including the current water law.

The facilitators have contributed to building capacity in their respective localities on the local governance of water resources. Supported by educational material adapted to the local context, the training has strengthened local knowledge of water tenure and water governance concepts, as well as providing practical advice, for example, how to apply for a water permit and how to resolve water resource conflicts.

The training has thus far reached more than a hundred people in the two research locations (Saint Louis and Podor), including young people and women.

The need for local water governance platforms was discussed during the training sessions, which led to the initiation of consultations with broad stakeholder participation. CNCR continues to promote this process. Next steps will include the formal establishment of governance platforms, capacity building for the members and networking at the national level.

CNCR, with support from the KnoWat project, organized meetings on national challenges and issues related to water governance with the Steering Committee of the Voluntary Guidelines on the Governance of Lands, Forests and Fisheries in Senegal (COPIL DV/GF) and the Platform of Civil Society Organizations for Water and Sanitation in Senegal (POSCEAS).

The meetings strengthened the link between existing work on land governance in Senegal and the KnoWat approach to assessing water tenure. Land stakeholders recognized the relevance of taking water governance into account in their advocacy and awareness-raising work on climate change adaptation.

The KnoWat project has strongly supported CNCR's involvement in the World Water Forum, which enabled the mobilization of rural stakeholders and the development of a position paper on their concerns around water management and governance.

These interventions and promising results have enabled the KnoWat project to contribute to the revision of the water law in Senegal.

'The **KnoWat project** has helped to refine our water governance policies, programmes and strategies and directed them towards a more effective and efficient use of water resources".

Younoussa Mballo, Technical Advisor to the Senegalese Ministry of Agriculture, Rural Equipment and Food Sovereignty



Watch the video: Sustainable water management solutions in Yanze river basin, Rwanda

Rwanda: Supporting local water governance and management to address water scarcity

Within the main Nyabarongo Lower catchment, the Yanze subcatchment occupies an area of 9 685 hectares, equal to around ten rugby fields. The subcatchment is home to a variety of water users. Irrigated vegetable and fruit production can be found in the valleys and farmers produce maize and potatoes on the hillsides.

Other water users include coffee washing stations, water treatment plants, mineral extraction sites, small-scale irrigation and the Water and Sanitation Company (WASAC), which extracts water to supply Rwanda's capital, Kigali. In recent years, water has grown scarce in the area, leading the WASAC and local farmers to make agreements governing the sharing of water resources.

The KnoWat project in Rwanda worked with Yanze Horticulture Production Cooperative (YAHOPROC), a cooperative of vegetable growers, to support sustainable water resources management options:

Clean energy to benefit people and nature. Vegetable farmers found it difficult to distribute adequate irrigation water using watering cans and treadle pumps, limiting their production. In response, the project distributed three solar-powered irrigation pumps and trained farmers to operate and maintain them. The solar-power pumps allow farmers to grow crops throughout the year. Because the pumps are simple to operate and maintain, they can be used by all farmers, regardless of age.

Integration of fish farming and pig rearing. The KnoWat project piloted two strategies to diversify income. Farmers stocked three irrigation ponds with Tilapia fingerlings, and the project supported the cooperative in pig rearing. As a result, the cooperative has so far harvested 376.5 kilograms of Tilapia fish worth USD 750.

Starting with the 30 pigs supplied by the project, members of the cooperative have raised around 300 pigs. The farmers have raised their incomes by selling both fish and pigs. The project supported these activities by providing training on improving market access. As a further benefits, the manure from fish and pig production serves as organic fertilizer, and fish and meat diversify the diets and improve the nutrition of local families.

Building institutions to improve water governance. The project worked with the cooperative and local leaders to build their capacity to establish a water users' association in the Yanze subcatchment. Through the association, farmers will be able to obtain a water permit, providing long-term sure access to water resources.

Rwanda: Water users and uses assessment

The Rwanda Water Resources Board (RWB) with support of FAO's KnoWat project and Best Associated Consultants, developed an approach to water users and uses assessment that allows information collected in the field to be entered directly into a central database from smartphones or tablets.

The approach enables the RWB to continually update national-level data on water users and users.

RWB staff received on-the-job training in using and maintaining the software and tools for data collection and update. Data were collected in the twenty Level 2 catchments in Rwanda and used to update the national database. Level 2 catchments are hydrographic units defined by RWB as a basis for water resources management in Rwanda.

In 2021, the results of the updated water use and users assessment were endorsed by key stakeholders in a national validation workshop.

The assessment recorded annual water use of about 608 million m³ in 2019 compared to 499 million m³ registered in 2017, an increase of 22 percent. This increase was partly due to higher water abstraction and partly to improved assessment methodology.

Hydropower is by far the biggest user of water resources, accounting for more than 3 382 million m³/year. The hydropower sector contributes about 55 percent of Rwanda's capacity in energy production, particularly in the western part of the country. Water use for hydropower is considered non-consumptive.

Water abstraction in Rwanda (2019)

 	Irrigation 59.7 %	
Â	Domestic use 38.6	%
\wedge	Other 17%	

(such as mining, industry, etc.)



Excluding hydropower, water is mainly abstracted for irrigation (363 million m³/year, 59.7 percent), and domestic water supply (235 million m³/year, 38.6 percent). The high abstraction by the agricultural sector can be explained by the importance of agriculture to Rwanda: agriculture contributes over 30 percent of the country's gross domestic product; about 48 500 hectares of agricultural land are irrigated.

Abstraction for irrigated agriculture is likely to increase in future, as the government plans to expand the area under irrigation to 102 281 ha by 2025. Mining, industries, fishponds and coffee washing stations account for less than 2 percent of abstractions.

2 139 major water users were identified and mapped in Level 2 catchments, of which 377 were mapped using the new approach to data collection. At the time of the assessment (2020), only 14 percent of the assessed water users held a permit.

The regularly updated information on water users and uses made possible by the new approach is an important input for sound water resources planning in Rwanda. It enables decision-makers and practitioners in public and private sectors to take informed decisions on the equitable and efficient allocation of water resources, even under conditions of climate change. It also allows water managers to identify and address actual or potential conflicts over water use in catchments.

The RWB aims to share the format of the database with other organizations to ensure consistency in acquiring and storing data on water use and users. The information is updated at the end of every year.



Further information

Use the QR code to download the Water Users and Uses Assessment report and learn more about the project results and activities in Rwanda.

www.fao.org/in-action/knowat

"Rwanda's rapid population growth and industrial development as well as the implementation of the National Strategy for Transformation (NST) are likely to increase the demand for water.

Based on current trends, the level of water scarcity will increase. For this reason, it is important for the central and local governments to have accurate data on the various users of water, water uses and sources, and to be able to monitor the extent to which water users are operating with water abstraction permits.

Appropriate decisions on water use management require consistent, comprehensive and reliable water use data."

Alsaad Ndayizeye, River Flood Control Specialist Rwanda Water Resources Board (RWB)



Stories from the field

KnoWat stories from the field: Meet the people who make a difference

The KnoWat project has strengthened the capacities of key actors in Rwanda, Senegal and Sri Lanka in the management of precious water resources through better water accounting, tenure, and productivity assessment. Three articles tell the story of people who have made a difference on the ground.

Meet Jean d'Arc Mubaranyanga, a broccoli farmer in Rulindo, Rwanda, Ousmane Ly, a pastoralist in the Senegal river Delta, and Medhani Jayakody, Chief Engineer at the at Sri Lanka's Irrigation Department, as they relate how KnoWat has supported them in making better-informed decisions about water resources.



Follow the QR code to read the stories from the field.

www.fao.org/in-action/knowat

Harnessing source of life in Rwanda

The Yanze catchment is located close to Kigali, capital of Rwanda. The scenery is mountainous, as can be expected in the 'Land of a Thousand Hills'. Cultivation on terraces shape the hillsides like big stairs, with small farms every here and there.

A 31-year-old farmer Marcel Munyawera sits next to a fishpond in Yanze and frowns, when he tells how the situation was before FAO supported the construction of water harvesting dams, which now also work as fishponds, to the area.

"Before the project [a FAO project in the area before the KnoWat project] provided the dams, we used to have conflicts due to water scarcity. Everyone was fighting for the wetland," he tells with a serious face.

The Yanze catchment is a source of life for its over 68 100 inhabitants: the water from the catchment is used for drinking, cooking and bathing, and for agriculture. Most of its rural population are vegetable farmers, and around 40 percent are considered as poor. Without water, crops do not grow, there is nothing to sell and families cannot afford food.

Due to its proximity with the capital, a greater part of water used in Kigali City is abstracted directly from the Yanze River. The capital's population is growing and the city uses more water, reducing the water available for farmers in the catchment.

Sustainable solutions

From 2019 to 2022, the KnoWat project worked together with Action for Environment Protection and Promotion of Agricultural Sector (APEFA) to tackle water scarcity and improve local water management solutions in the Yanze catchment. The six dams acquired from FAO were used to collect water for irrigating vegetables in the area, but the farmers found it difficult to irrigate the fields adequately using watering cans and treadle pumps, thus limiting their production.

The KnoWat project leveraged on the FAO's previous support and improved the irrigation system by distributing three solar-powered irrigation pumps to the local vegetable producing cooperative (Yanze Horticulture Promotion Cooperative, YAHOPROC), which has 245 members.

"We no longer sit idly during the sunny season, worrying about how we can irrigate. There is no such problem now, we have water and a machine which automatically pumps it for us," tells Jean d'Arc Mubaranyanga, a broccoli farmer and a member of YAHOPROC. She is watering a farmland with one of the new light solar irrigation pumps.

W.A. Ramani Perera drying harvested paddy. © FAO/Kolitha Bandara With the previous equipment, irrigation was too physical, especially for some women. Today, thanks to the new solar pumps, farmers can cultivate all year round and have higher yields. "Before, I could barely harvest 60 kilograms of broccoli per season on two acres. Since I started using this solar-powered pump, I easily harvest 200 kilograms."

The increased yields have generated more income too. Jean d'Arc looks positively toward her future. "Before getting this technology and have increased yield, I didn't have a bank account and I had no idea of where banks were. Now, I have an account, I save and have money to buy an asset for my development so I will have a better life when I am old and unable to work."

Even farmers' diets have improved. "We could not eat vegetables before, now our nutrition is improved. We no longer have malnutrition issues. Children don't suffer from Kuashiorkor (severe malnutrition)," she adds.

Another project innovation concentrated on two strategies to diversify income, by supplying 30 pigs and 5 000 fingerlings to stock in three dams. The cooperative has now raised around 300 pigs and farmers' income has increased from selling both fish and pigs.

'One year after I received the pig, I have earned 150 000 RF (USD 150). I managed to pay the school fees of my child, I was able to cover other basic needs and my house has solar electricity, with manure I harvest more vegetables. Life is good," Louise Mukatumusenge, a farmer, describes her life now.

To ensure the sustainable use of water, more than 700 farmers in Yanze were trained to sustainably use the available water.

"We no longer sit idly during sunny season worrying about how we can irrigate our crops."

Jean d'Arc Mubaranyanga, vegetable farmer



Further information

Use the QR code to learn more about the KnoWat project results in **Rwanda**.

www.fao.org/in-action/knowat

Safeguarding water rights for future

However, as the effects of climate change and population growth are expected to increase, so will the competition on water. How to make sure the water in Yanze will be allocated in an equitable manner for all users?

These types of policy-decisions, plans and investments can be made only if we know, how people, communities and organizations gain access to, and use water resources, how much of the water can be used, for how long, for what purpose and under what conditions. In short: we need to know the water tenure.

The KnoWat project launched a pioneering water tenure assessment in Yanze to identify and analyse the different water tenure arrangements in the country, working closely with YAHOPROC and its members.

"One of the key findings in Yanze was that the vegetable farmers use the water resources in an informal way and are not always aware of its legal requirements. If the water is used for small scale irrigation activities, you don't need a permit for that. However, as the farmers use water from the dams, they should be under the permit regime. For example, what would happen if the city of Kigali requires so much water that there is not enough for the small farmers in Yanze?," explains the KnoWat project's National Coordinator, Joseph Bizima.

The overall findings and recommendations of the assessment which address key water resources management issues in Yanze and another pilot location were presented and validated in March 2022. Different key stakeholders participated in the water tenure validation workshop including RWB, RAB, Water and Sanitation Corporation, representatives of the local authorities, water engineers, and other actors in the water sector. International experts of FAO also participated in the event virtually.

The recommendations of the assessment include a water fee structure based on water use category so that high impact users pay according to use levels, and awareness campaigns and capacity building to raise water users' understanding of existing legal requirements governing land and water resources.

Bernard Musana, Head of Knowledge and Forecasting Hub Department at Rwanda Water Resources Board, welcomed the water tenure assessment report and commended the work done by FAO under the KnoWat project. The project already took action and worked with the YAHOPROC cooperative and local leaders to build their capacity to establish a water users' association in the Yanze catchment.

"Through the association, farmers will be able to obtain a water permit, providing long-term secure access to water resources to sustain their production systems", Bizima continues. But naturally the project team hopes that the recommendations would inspire action on other levels too. Because to combat water scarcity, concerted actions are needed at local, regional, national and international levels. "Through our KnoWat project in Rwanda, Senegal and Sri Lanka, we have aimed to improve water governance processes with different activities, put the topic of water tenure on to political agendas and acknowledge it as a crucial element of development. Besides the three countries, we have wanted to contribute to the global work and discourse on water tenure", tells Benjamin Kiersch, Global Coordinator of the project. Secure water tenure rights, especially for rural people living in water scarce areas, are essential for food security – and basically for inclusive and just development" summarizes Kiersch.

Meanwhile in Yanze, the river flows forward, as well as the people in the catchment, thanks to the new water solutions.

Senegal: poems and a project for peace

In northern Senegal there is a fishing village called Ngaolé next to the Senegal River. The river partly marks the border between Senegal and Mauritania and is only a short distance from the Sahara – the world's largest hot desert. Wooden canoes used by fishermen can often be seen on the red banks of the river, which is famously occupied by crocodiles. But the fishermen are not afraid. During local ceremonies, 'pekaans' or long poems are sung to the water spirits to protect the fishermen and the community from harm.

This protection is needed now more than ever as communities face new challenges from climate change, prolonged droughts and population growth. The overexploitation of groundwater and pollution have led to water scarcity. This has greatly aggravated the already difficult lives of many people in the rural north. Poverty and food insecurity are prevalent in the area, where most people engage in fishing, livestock rearing or subsistence farming.

Combined with a lack of clarity over water access and management rights, the scarcity of water resources often leads to conflict between herders and farmers. Moving from one place to another, pastoralists need water for their livestock, but farmers are not always willing to share their limited water resources.

Ousmane Ly, 59, is a pastoralist who lives in Guia, close to Ngaolé. According to Ly, because of climate change, the livestock in the area has been considerably reduced as the grazing space has shrunk. Due to the scarcity of fodder and water points, early and prolonged transhumance is the only alternative for local pastoralists. This can cause tension – and even conflict – between farmers and herders. According to Ly, "The reduction of grazing areas and the distance to water points are due, on the one hand, to the galloping demography with the consequences of the extension of villages and small towns (Taredji, Ndioum) on the cattle routes for access to water or grazing areas; on the other hand, to the hydroagricultural developments (Ngallenka, Nianga casier, etc.)."



Further information

Use the QR code to learn more about the KnoWat project results in **Senegal**.

www.fao.org/in-action/knowat

The FAO KnoWAT project has provided a concrete solution to this problem through the evaluation of water tenure. This assessment should be extended to all of Senegal and the countries of the Senegal River Basin to promote social cohesion and peace between different water users.

FAO's work on equitable water access and use

The KnoWat project carried out a water tenure assessment in two areas of the Senegal River Basin, Podor (adjacent to Ngaolé village) and the Gorom-Lampsar axis in Saint-Louis, to support the equitable allocation of water to users in these areas. In addition, a WaPOR (WAter Productivity through Open-access of Remotely-sensed derived data) database on water consumption and productivity was developed and the project team conducted capacity building activities on water resources assessment for technical staff in the country from 2019 to 2022.

Formal laws give people legal rights to use and access water, but these rights are often also determined by local habits and customs. The problem is that these customs do not guarantee people's right to use and access water. According to Sofia Espinosa, a land and water specialist at FAO and one of the supervisors of the water tenure assessment in Senegal:

"During the assessment, we discovered that some rivers in the Senegal River Basin are considered sacred by the local population and have not been touched for generations. But there is no document that gives them this right. Imagine if these rivers were suddenly used, for example for irrigation, by someone who had acquired a legal right to them? That would be terrible for the local people. That's why we need to study these different tenures, in order to protect local people's access to and use of water."

Since water tenure assessment is a new concept, the KnoWat project developed a methodology for the process. The methodology is a balanced approach that employs desk research, fieldwork for data collection, training

Mr Samba BA, called "Ngary Ngaolé" Sings during traditional "Pekaans" ceremonies to glorify the actors, encourage them and remind them of the exploits of their ancestors.

© FAO/Lamine Samake

and participatory consultations with policymakers, national stakeholders and local people that depend on water for their livelihoods. It examines official laws and policies, their implementation and enforcement.

In Senegal, the assessment found that there are many other types of water tenure that are legitimate based on custom or religious belief but do not fall within the country's legal framework.

"Besides this example of customary use of water resources, people have a practice of fishing in the Senegal River, but the legal framework does not recognize this type of custom, and the fishermen are not yet aware of it. Similarly, some farmers in the region are involved in flood recession farming, but if there are dams in certain areas, this type of farming will be threatened and reduced to a minimum," said Sofia Espinosa.

Protecting and securing local practices by including them in the legal framework, or finding an alternative solution, would bring greater security to people by protecting their livelihoods and customs.

Babacar Diop, agropastoralist in Ross Bethio and administrator of the Conseil National de Concertation des Ruraux (CNCR).

"The advantage of [the KnoWat] project is that we have interrogated the traditional and legal arrangements of water governance and we have many ... difficulties related to water management in the Senegal River Basin. A deep understanding of these difficulties has therefore been [made] possible thanks to the water tenure assessment study and our aim now is to ensure that this approach and the results obtained are disseminated and known to the public, in particular to decision-makers at national and local levels," said Babacar Diop, an agropastoralist in Ross Bethio and administrator of the Conseil National de Concertation des Ruraux (CNCR).

Perfect timing

Senegal is currently involved in the process of revising its water law. The water tenure assessment, and its recommendations, are expected to contribute to this process.

"We held a validation workshop at both local and national levels with stakeholders, some of whom are also already involved in the revision of the water code. At the end of these workshops, the evaluation report was validated in May 2022 in Dakar by all the actors involved, which is promising," explained Lamine Samaké, KnoWat's National Coordinator.

Younoussa Mballo, Technical Advisor to the Senegalese Ministry of Agriculture, Rural Equipment and Food Sovereignty, considers the project's work to have been useful: "We believe that the KnoWat project has helped to refine our water governance policies, programmes and strategies and directed them towards a more effective and efficient use of water resources. Senegal is endowed with a large amount of water resources and these resources will be managed even better considering the results





Exchange meeting with the religious authorities of Podor, October 2021. Photo credit: © FAO/Lamine Samake obtained throughout the KnoWAT project. In the end, we believe that if there are still issues to be clarified in this process, we should see how to continue this work and especially how to scale it up."

While Senegal is on track to address its water challenges, the situation remains alarming at the global level. "More than 733 million people currently live in areas of high or critical water stress, and global water demand is expected to increase by 30 percent by 2050. Agriculture is by far the biggest user, accounting for 72 percent of global water withdrawals. The question is how to solve this puzzle for sustainable development for people and the planet? We believe that responsible water governance, including work on water tenure, is an important tool to address the challenge of the decade," concluded Benjamin Kiersch, global coordinator of the KnoWat project.

Reaping the fruits of data in the paddy in Sri Lanka

In Sri Lanka, an island in the Indian Ocean, a shimmery green river snakes through paddy fields and forests, unhurriedly towards the ocean in the northern part of the country. The 164-kilometer long Malwathu Oya river is the second longest river in the country and a lifeline for people living nearby.

The river's southern catchment supports around 200 000 local people, who are mostly engaged in farming, providing them with water for drinking, sanitation, hygiene, and to irrigate their paddies.

The cultivation of rice has been practiced here for thousands of years: ancient civilizations flourished in the dry area of the country partly due to their irrigation systems. Sri Lanka was once known as the 'granary of the east.' To this day, the cultivation of rice is essential to Sri Lanka's people, their culture and the economy: 43 percent of all agriculture lands are under paddy, and rice contributes to 1.8 percent of country's GDP.

But in recent times, some paddies have been unable to produce, due to the impacts of climate change and related extreme weather events, such as prolonged droughts and fierce floods. "Drought destroyed the harvest of one cultivation season in 2012 and then we had floods submerging our paddy fields. Our crops have been destroyed twice by floods since 2016," explained W.A. Ramani Perera, President of the Ranketha Farmer's Association and Treasurer of the Farmer's Association.

Since most of the southern catchment's inhabitants are engaged in farming, a lost harvest means the loss of an important part of their income and even food – normally the farmers have two harvests per year. This begged the question: what could be done to plan and manage better water resources in the southern catchment to control floods and to ensure enough water for irrigation, even during dry periods?



Further information

Use the QR code to learn more about the KnoWat project results in **Sri Lanka**.

www.fao.org/in-action/knowat

Cutting-edge data and intense training

From 2019 to 2022, FAO's KnoWat project carried out a number of activities in the Malwathu Oya southern catchment and at the national level to improve water resources planning and management.

The first step was to establish a near-real-time database on agricultural water consumption and water productivity, building on FAO's Water Productivity Open-access portal (WaPOR). The database was created by analysing satellite images and comparing them to on-the-ground observations. Prior to the project, data and information was inadequate to allow proper planning and management of water resources. The water balance was done by hand and based on field observations, requiring a great deal of time and energy.

'[Manually g]athering ...[all of the] hydro-metrological and climatic data needed [for] assessing and improving water resources was difficult ...," confirmed Medhani Jayakody, Chief Engineer of the Water Resources Planning Branch at the Irrigation Department of Sri Lanka.

The WaPOR data from the catchment, as well as national data at different resolutions, are now freely available to water resource management officers for conducting water balance studies.

Sri Lanka is the first Asian country to have the WaPOR database. The map shows crop water productivity in the project area in December 2021: the greener the area, the higher the crop water productivity; the grey areas have low water productivity.

Water accounting and auditing training for postgraduate students on 28–31 March 2022 at the University of Peradeniya. © FAO/Sri Lanka office 'Allowing [us] to use near real-time data with acceptable resolutions, WaPOR is going to bridge the gaps in data, cut down the cost and filling the gaps in new technology in water resources assessment" said T. K. A. Kodippili, an engineer at the Irrigation Department of Sri Lanka.

The KnoWat project also built the capacity of local people to use the WaPOR database. Thirty men and women from different water sector agencies in Sri Lanka received training on water accounting and auditing. In addition, the project engaged with the next generation of water decision-makers, by assisting universities to include WaPOR on the curricula of agronomy students and to incorporate WaPOR into research projects.

Today, engineers, water management experts and academics can get a wealth of information from WaPOR that will help them to find solutions for managing water better in catchments and irrigation schemes.

"Using water productivity assessments at scheme level will be important in seasonal planning for better water management, and the decisions can be made ...[at the start] of the season on the best crop type, water quantity to be used," explained Medhani A. Jayakody.

Water resources managers reap the benefits of the data, but farmers are the ultimate beneficiaries. 'A farmer who lives in a remote village does not know anything about WaPOR, but can benefit from WaPOR through a designed plan for proper water management after assessing the water productivity on ...[their] plot. The benefit they will receive is a good harvest due to having improved water management and seasonal planning. The good plan can ensure them a good income from their cultivations," explained T.K.A. Kodippili.

Moving forward with new knowledge

Water managers have long maintained that good water resources management is critical to the equitable access and use of water. In times of water-related challenges, such as brought on by climate change, water accounting and auditing are essential aspects of planning water resources management. Water accounting involves the systematic examination of the status and trends in the availability, demand, accessibility and use of water. Water auditing, on the other hand, examines trends in water supply, demand, accessibility and use in the broader framework of governance, institutions, public and private expenditure, law and political economy. When combined, results from water accounting and auditing facilitate policy development and decision-making.

The KnoWat project carried out a water accounting and auditing assessment in Sri Lanka's Malwathu Oy southern catchment, as well as a water productivity study in an area identified as having low water productivity. The water accounting study focused on ten subwatersheds in the Malwathu Oya southern catchment over four seasons. In each case, water balances were calculated using the Soil and Water Assessment Tool (SWOT), which is commonly used by the Irrigation Department of Sri Lanka, with inputs from the WaPOR database. These balances were compared with observed hydrological data. The flows calculated with SWOT and WaPOR were generally higher than the observed flows, by about 4 to 13 percent. This indicates that the model replicates the situation on the ground quite well and can be used in future water balance studies.

The water auditing case studies focused on three cases of unsustainable water management: i) water sharing between agriculture and domestic water uses and the unavailability of water from a tank in Thuruwila; ii) the Nuwara Wewa feeder canal and the illegal use of water; and iii) areas of low water productivity in the Nachchaduwa irrigation scheme.

In Thuruwila, it was discovered that by improving collaboration between farmers and area officials, the farmers were encouraged to share their practical knowledge in the high-level discussions, helping to resolve the water-sharing issue. In the Nachchaduwa-Nuwara Wewa feeder canal, officials concluded that the use of water for irrigation should be legalized because siphoning is difficult to control. In the Nachchaduwa irrigation scheme, the study revealed that inadequate maintenance and cleaning have led to flooding and, as a result, low water productivity. The study called for improvements to the canal system and better facilities for accessing and using the canal infrastructure.

Each area has its own challenges related to water management. Thanks to the water accounting and auditing assessments and the validation workshops, the stakeholders and decision-makers have now more information [on which] to base their decisions for development, explained Thushara Ranasinghe, KnoWat project's National Coordinator in Sri Lanka.

A strong focus on water management is critically important for Sri Lanka, as the population continues to increase and climate change increasingly impacts the food security of rural people.

...[T]he challenge of the decade is how to feed the planet's growing population sustainably, amidst climate and water crisis? With more than 733 million people currently living in areas of high or critical water stress and a projected 30 percent increase in global water demand by 2050, water allocation has never been more important, said the project's global coordinator, Benjamin Kiersch.

Over four years, from 2019 to 2022, the KnoWat project worked to improve water resources management in Rwanda, Senegal and Sri Lanka. The results of the project in the three countries will complement FAO's work on water tenure, as it initiates a 'Global Dialogue on Water Tenure.'



Sri Lanka is the first Asian country to have the WaPOR database. The map shows crop water productivity in the project area in December 2021: the greener the area, the higher the crop water productivity; the grey areas have low water productivity. Source: Water Productivity through Open-access of Remotely sensed derived data (WaPOR). Map conforms with UN Geospatial. 2020. Map of Sri Lanka. Cited on 17 May 2023. New York, United States of America. https://www.un.org/geospatial/conte nt/sri-lanka-0

Information resources



Water tenure assessment methodology

A water tenure assessment seeks to identify and compare the different types of water tenure arrangements that exist within a given geographical area and to assess how people access and use water resources. Such an assessment can provide key elements for inclusion in strategies to attain sustainable development goals, and put into practice the 2030 Agenda principle of 'Leave no one behind'.

This guide is a working document which will be field tested in Rwanda, Senegal and Sri Lanka before the final publication. If you wish to receive a copy, please contact Sofia.Espinosa@fao.org.



Unpacking water tenure for improved food security and sustainable development

This paper contains the Policy Brief on water tenure and the Expert Roundtable summary report on water tenure, which took place in December 2019.



Exploring the concept of water tenure

This paper provides a preliminary typology of water tenure.



Water accounting and auditing - A sourcebook

This publication provides advice on the application and use of water accounting and auditing. It helps users planning and implementing processes most appropriate for their capacity and needs.



VGGT

Voluntary Guidelines on the Responsible Governance of Tenure

This publication provides guidelines to improve the governance of tenure of land, fisheries and forests.



Coping with water scarcity -An action framework for food and agriculture

This publication presents a conceptual framework to address food security in a context of water scarcity.



Further information

Use the QR code to access the project's resources section and download the publications. This project was supported by the Federal Ministry of Food and Agriculture of Germany (BMEL) and implemented by the Food and Agriculture Organization of the United Nations (FAO).



Federal Ministry of Food and Agriculture

At country level, the project was implemented with:

Rwanda Water Resources Board (RWB) Rwanda Agriculture and Animal Resources Development Board (RAB)



Ministry of Agriculture and Rural Equipment of Senegal Ministry of Water and Sanitation of Senegal Producer organizations





Department of Irrigation of Sri Lanka



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