International Water Management Institute

Boosting performance of irrigation and supporting productive water use through co-designed digital innovations using WaPOR data layers

Research and Innovation for Water Security

Driving Action • Propelling Change

XIX WORLD WATER CONGRESS

International Water Resources Association (IWRA)

Marrakech, Morocco| 1-5 December 2025

CGIAR RESEARCH CENTER

XIX WORLD WATER CONGRESS
International Water Resources Association (IWRA)
Marrakech, Morocco | 1 - 5 December 2025

Session targeting the use of **remote sensing** data sets for **productive water use** in irrigation schemes

Co-organized by the **International Water Management Institute** and the **Food and Agriculture Organization** of the United Nations

Co-design and co-development process to create tool for

FAO FIAT PANIS

IWMI International Water Management Institute

Food and Agriculture Organization of the United Nations

WaPOR

FAO's portal to monitor Water Productivity through Open-access of Remotely sensed derived data

Water productivity monitoring through remote sensing: WaPOR

Livia Peiser
Head of Geospatial Unit
FAO Land and Water Division

Ministry of Foreign Affairs of the Netherlands

IWMI International Water Management Institute

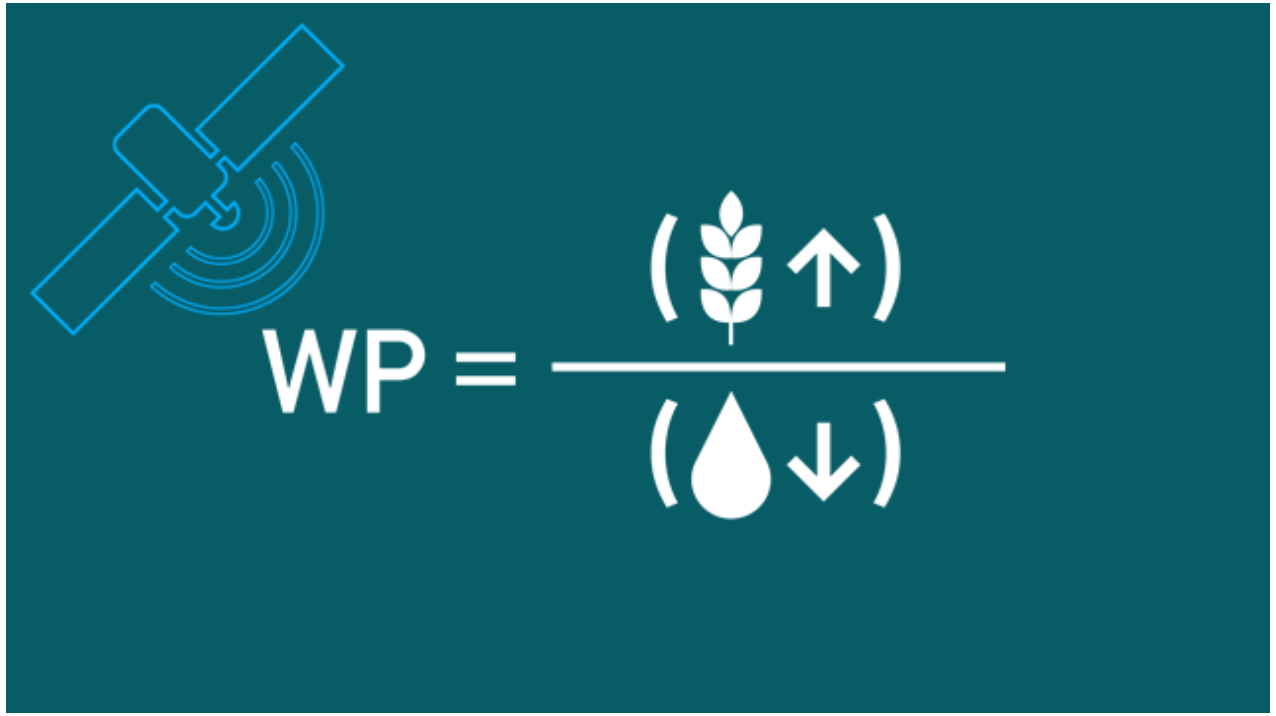
UNESCO IHE DELFT

Remote sensing of water productivity

Water productivity in agriculture measures the output (kg/ha) per unit of water consumed (m^3/ha).

Satellites can help monitor water productivity in cost-effective ways.

Increasing water productivity is now a globally recognized target (SDG 6.4)



Data availability

- Water Productivity
- Actual Evapotranspiration (ETa)
- Reference Evapotranspiration
- Precipitation
- Relative root zone soil moisture
- Net Primary Production
- Quality layers

Daily (P, RET), dekadal, monthly, annual time steps

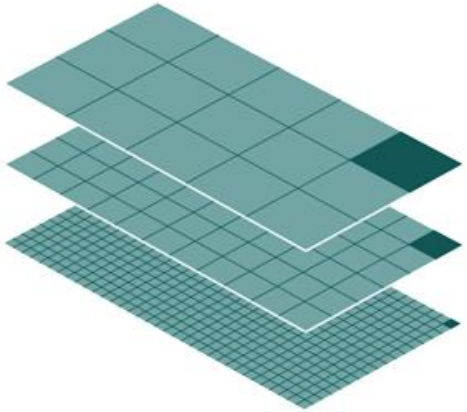
NRT update since 2018 (2009 on V2)

Ministry of Foreign Affairs of the Netherlands

WaPOR provides actionable information

Near-real time (every 10 days) data on biomass development and water consumption (actual evapotranspiration), in addition to agro-climatic parameters on a daily time step (reference ET and precipitation).

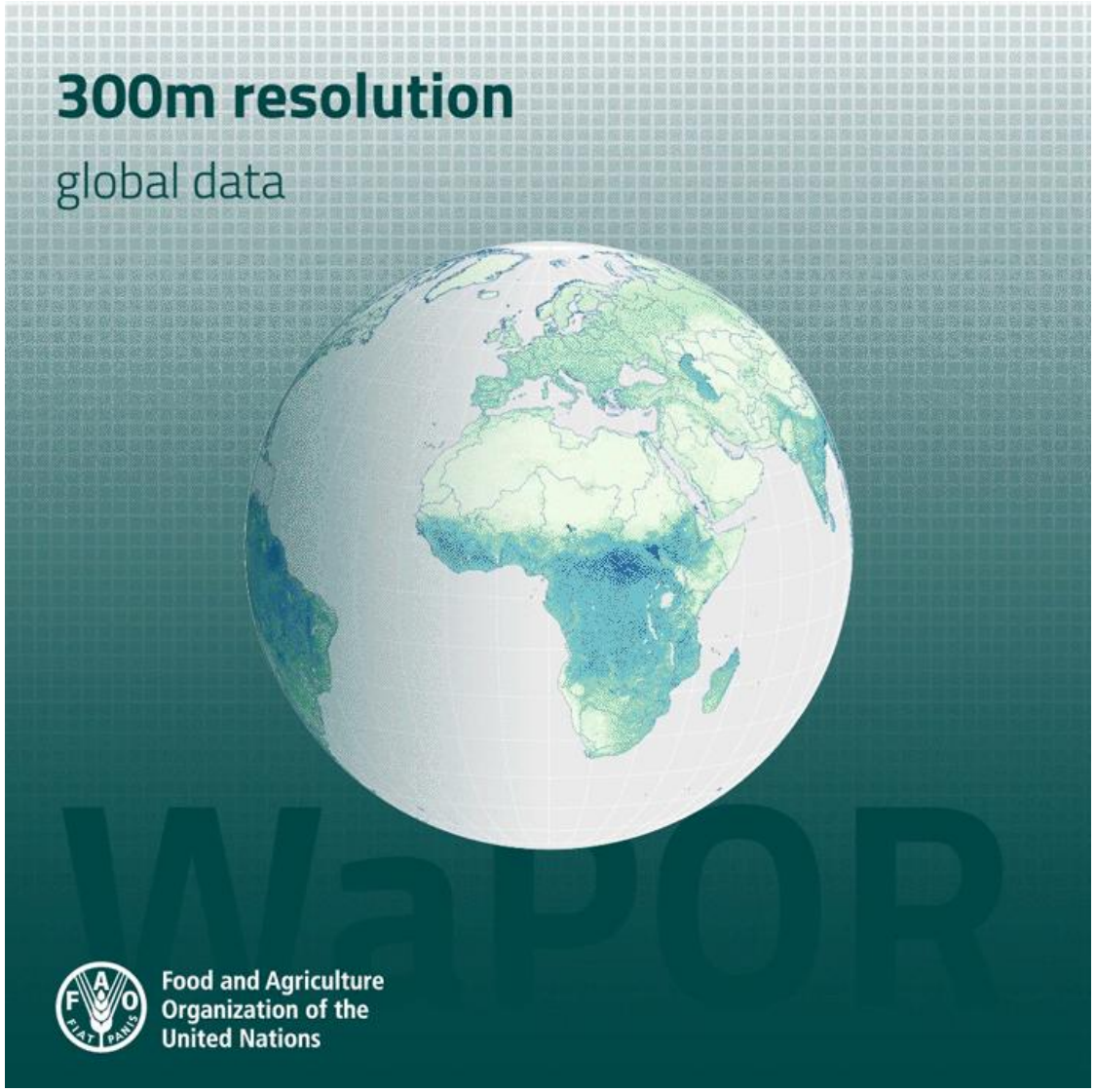
Spatial resolution ranges between 300 m and 20 m



300m

100m

20m (new test 10 m, daily data)



Knowledge sharing for sustainability

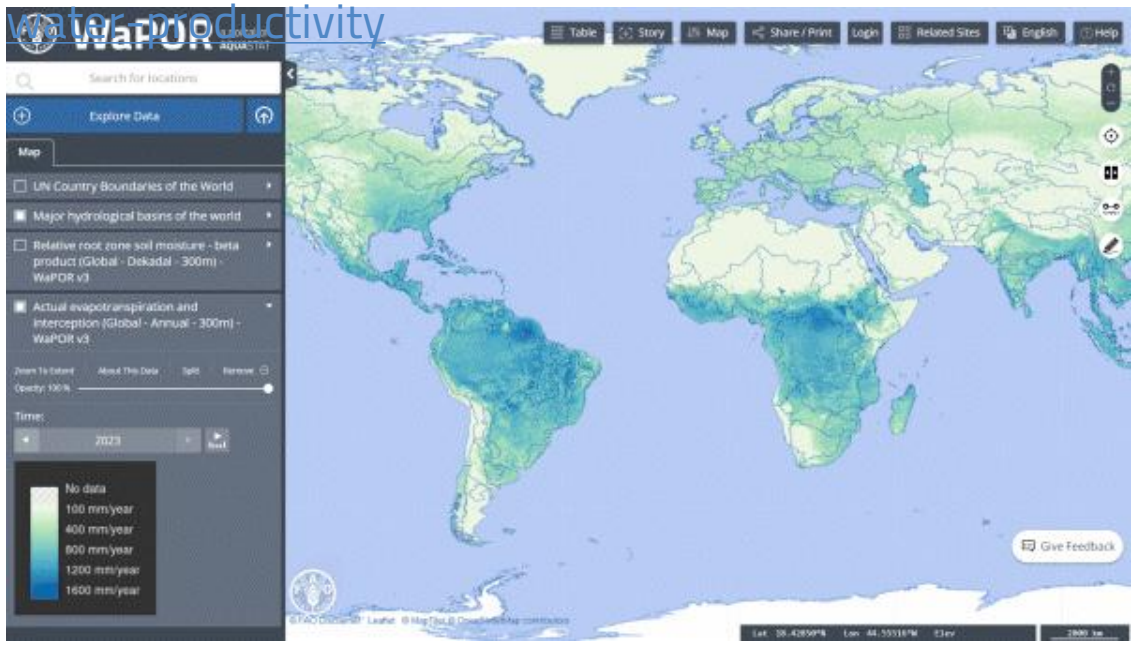
- Data distributed through ReST API for easier integration in ICT applications
- Open geospatial standards (wms, wcs, Cloud Optimized GeoTiff, STAC, OpenEO workflow)
- Open codes and algorithms: Wiki page for methodology
- **PyWaPOR** python
- Online courses, tutorials, hackatons
- Catalog of WaPOR applications and uses
- **Global ETa product by Copernicus in Dec 2025, WaPOR aligned**

Overview | **Data access** | Database | WaPOR activities

Accessing WaPOR data

Page contents:

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



Action-oriented data for different users

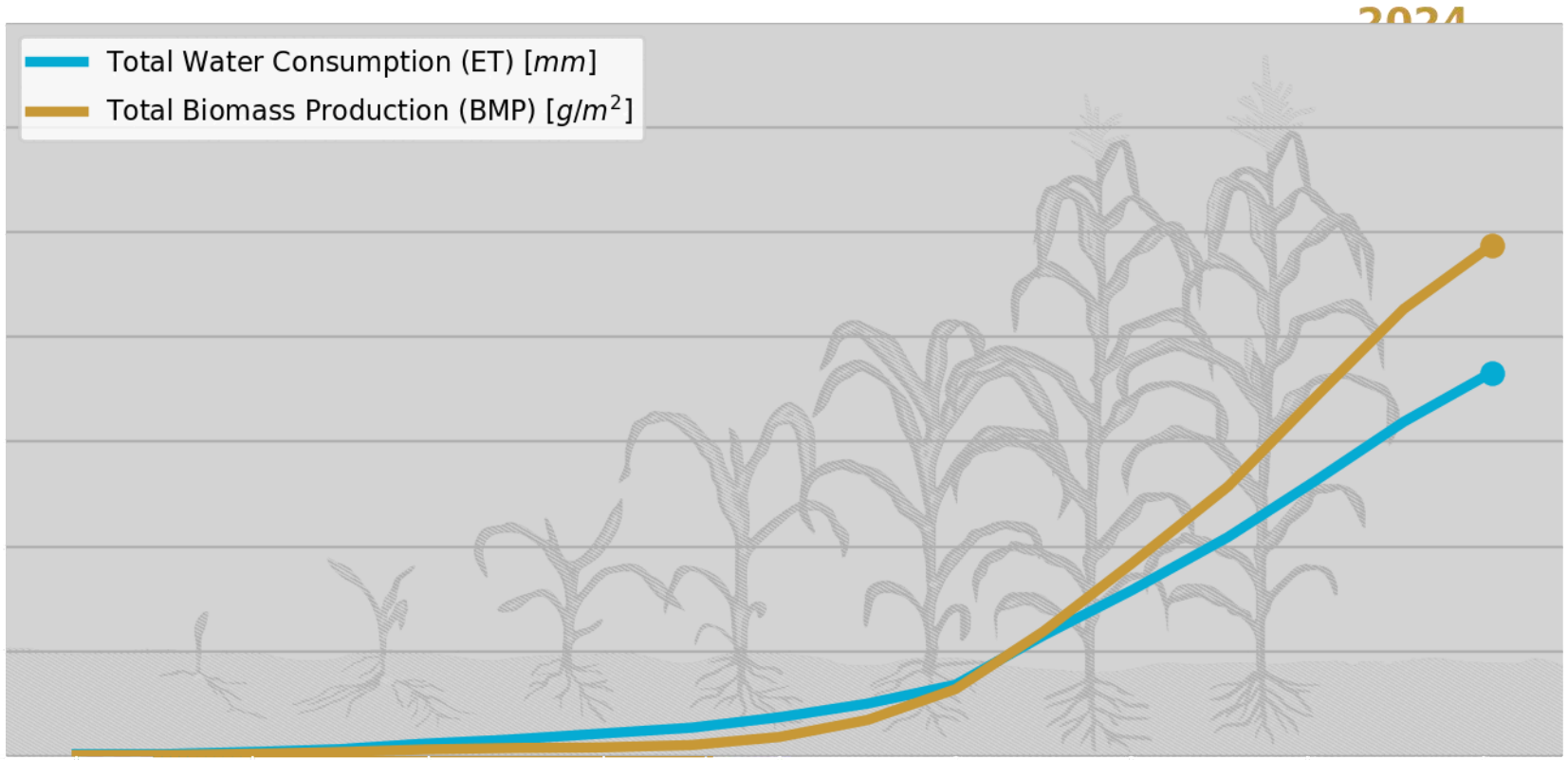
scale

Farmers and other end-users (app developers, agricultural entrepreneurs): advisory services

Irrigation scheme managers, WUAs, river basin authorities: monitoring water use and irrigation performance

Policy makers: water allocation strategies, water productivity targets, SDGs

Seasonal Progress



WaPOR: a Global Dataset for Water Action

Join us to build a water and food secure future where no one is left behind

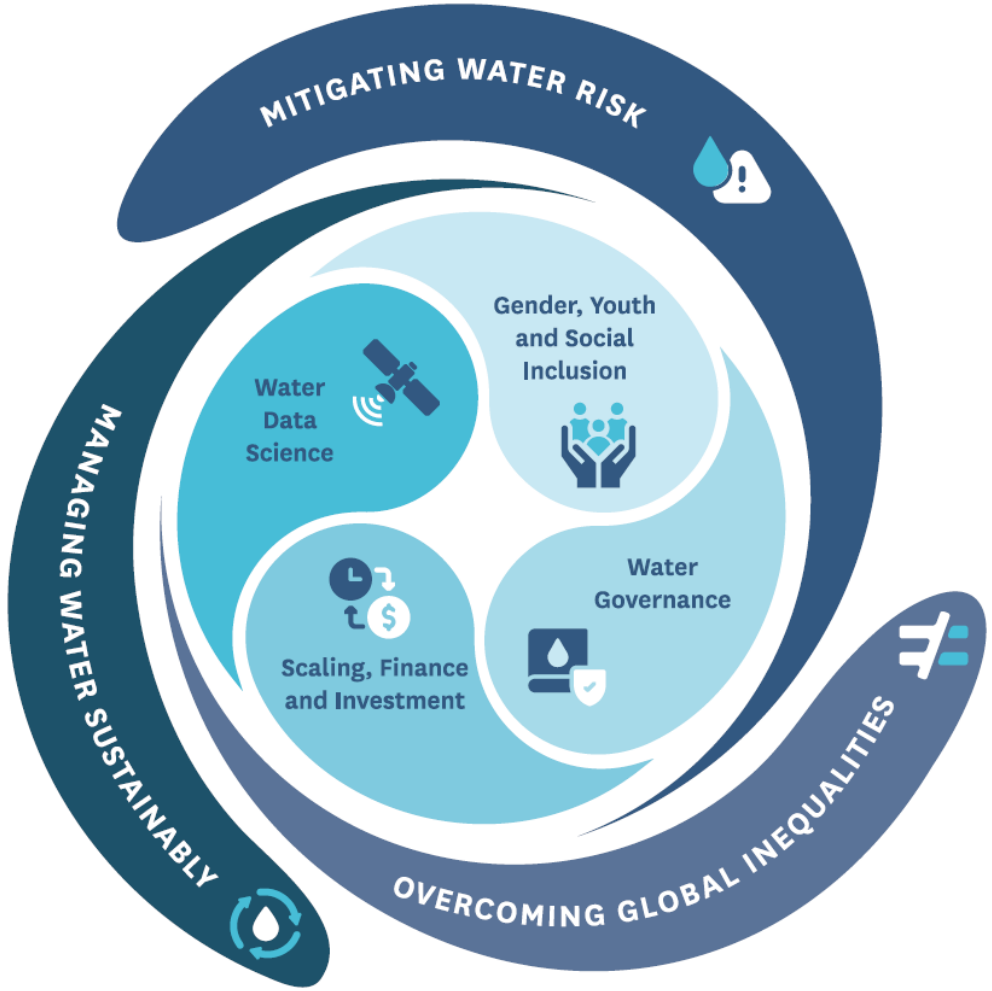
https://data.apps.fao.org/wapor

wapor@fao.org

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

Co-designing and co-developing digital tools to support irrigation management

International Water Management Institute



- Established 1984
- Member of the CGIAR
- Not-for-profit organization
- Research for Development
- Supporting governments, donors, private sector

IWMI International Water Management Institute

Co-design and co-development process

Goal:

Develop digital tools that use WaPOR open access data layers to support irrigation management.

- Follow a close **co-design and co-development process** with **national partners**.
- Ensure tools **meet needs** of national organizations to manage, monitor and evaluate water more efficiently.
- Capacitate partners to **operate, maintain and update** the tool **independently**.

Co-design and co-development process

IWMI is a partner in the WaPOR project with the primary role to co-design and co-develop **digital tools** with national partners

Tools were developed around various themes:

1. **Drought monitoring and mapping**
2. **Irrigation advisory services to farmers**
3. **Irrigation performance assessment and diagnosis**

Collaboration with **irrigation agencies**, **ministries** of agriculture, water resources, etc.

Co-design and co-development process

1. Creating demand

Opening workshop

Exposure to WaPOR

Identify opportunities

2. Joint needs assessment

Information requirements

Organizational processes

Memorandum of Understanding

3. Co-design tool

Participatory process

Tool components

Safety requirements

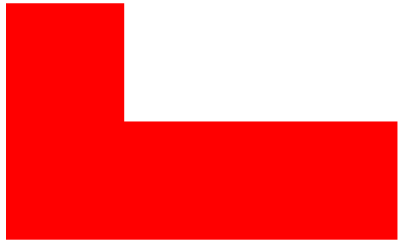
Co-design and co-development process

4. Tool development

Technical working group

Non-linear, reiterative process

Space for improvements



5. Operationalization

Capacity development

Institutionalize tool

Operation and maintenance plan

Official launch and handover

Co-design and co-development process

5 WaPOR-based tools were developed on **irrigation performance**

Tools combine **remote sensing data layers** from WaPOR, as well as **ground observations** on irrigation water allocations, crop production, etc.

Mali	**Kenya**	**Mozambique**
Iraq	**Morocco**	**Jordan**

West Gharraf Scheme Irrigation Performance Assessment Tool (IPAT)

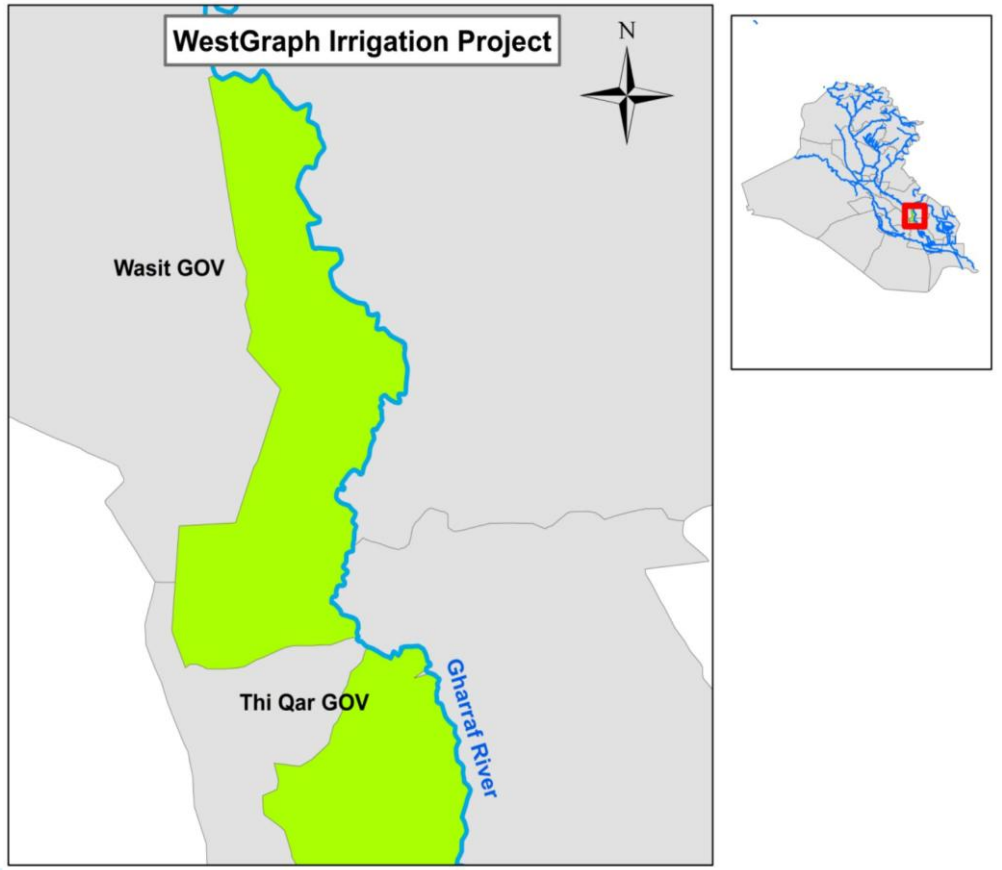
Galwah Talal Sami
Senior Chief Engineer

Ministry Of Water Resources In Iraq

responsible for , water managment reservoir, lakes ,rivers, branches and irrigation projects, and ensuring water security.

- WestGraph IR(DhiQar,Wasit)
- Area Gross 84,000hec,Culti24,000 hec)
- Surface Irrigation(Gharraf River)
- Crops

Season	Major Crops	Crops
Winter	Wheat, Barley	Wheat, Barley, Berseem, Vegetables
Summer		Maize Grain, Vegetables
Perennial		Orchards



West Gharraf Scheme Irrigation Performance Assessment Tool (IPAT)

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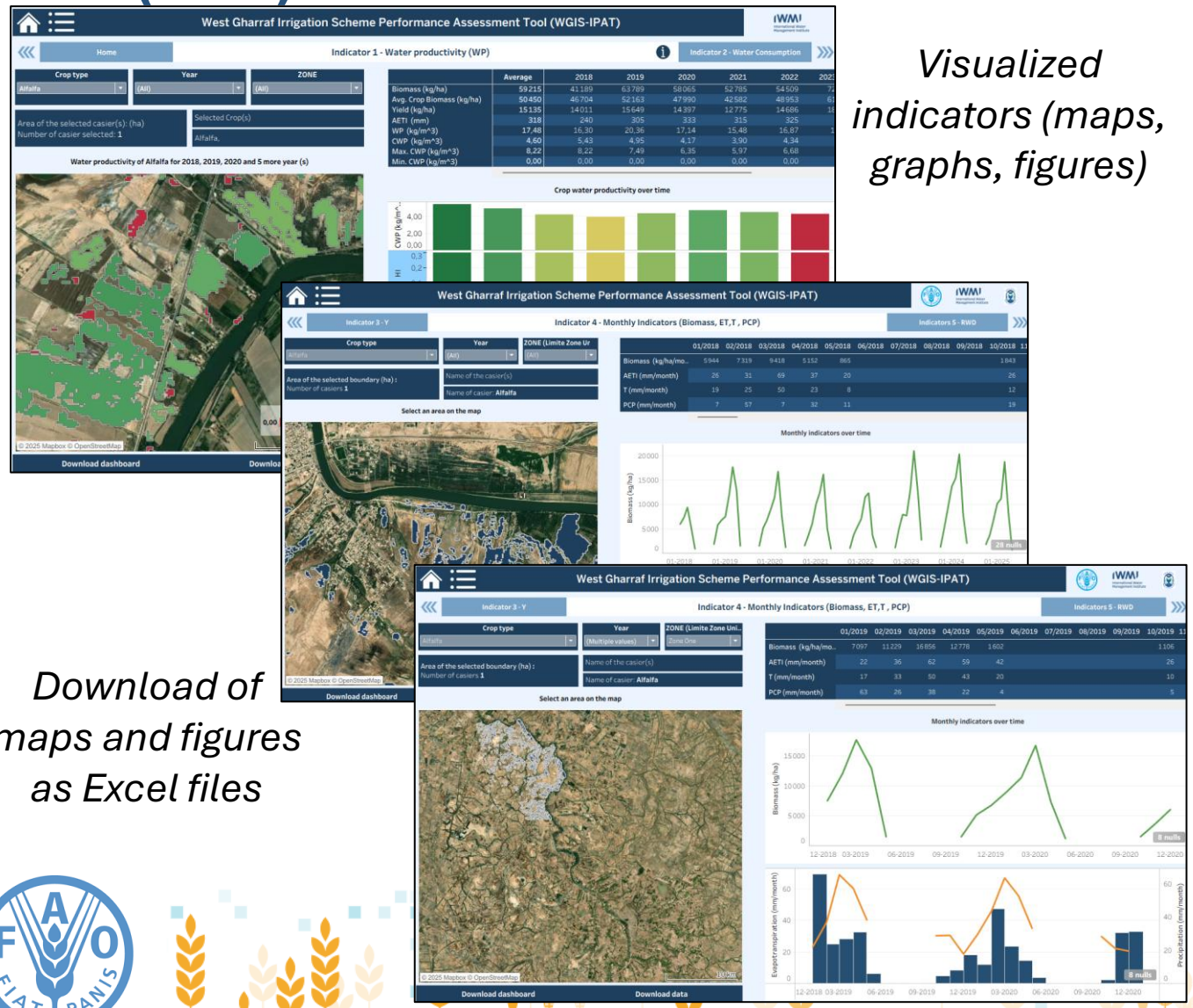


Visualized indicators (maps, graphs, figures)

Irrigation performance indicators

- Water Productivity (WP)
- Adequacy
- Crop water deficit (CWD)
- Relative water deficit (RWD)
- Irrigation Uniformity (IU)
- Water consumption (WC)
- Crop production (Y)

Download of maps and figures as Excel files

International Water Management Institute

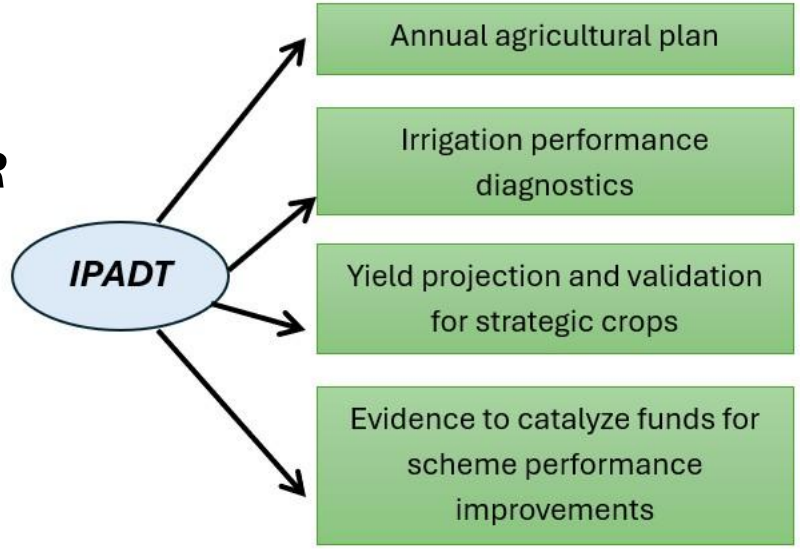
Tool and dashboard are completed – Transfer is anticipated in the second week of December 2025

On the job training

Final tool recap

April 30, 2024	July 31st- August 1st, 2024	September 3rd and 4th, 2024	20-24 April, 2025
Intro to WaPOR Data download and pre-processing	Irrigation management Raster calculator Farm digitizing Spatial analysis of WaPOR data (ETa, P, WP, ETref	Irrigation performance indicators (beneficial fraction, adequacy, Uniformity, relative water deficit)	Training week on the tool from A to Z

IPAT uses within MoWR



Irrigation Performante de l’Office du Niger (IPON)

Bakui KONE
Chargé de Mission

OFFICE DU NIGER

MALI

Office du Niger

Localisation : Ségou, Mali

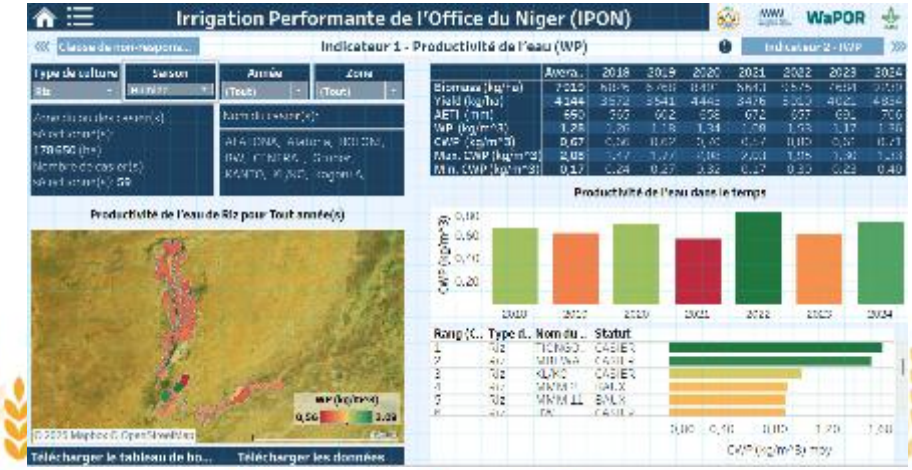
Mission : Aménagement et Gestion de Périmètre Irriguée

Description du périmètre irrigué : Irrigué d'un seul tenant par le **Barrage de Markala mise en service en 1947,** et situé dans le delta central du fleuve Niger, le périmètre irrigué de l'Office du Niger s'étend sur **1 947 000 ha aménageables** dont **145 000 ha aménagés** pour **91 000 Exploitants Agricoles** pratiquant **2 saisons** (1 Saison Humide en intégralité et 1 Saison Sèche en partie).

Outil d'Irrigation Performante de l'Office du Niger (Outil IPON)

IPON intègre neuf (9) indicateurs de performance : 1) Productivité de l'Eau (WP), 2) Productivité de l'Eau d'Irrigation (IWP), 3) Approvisionnement Relatif de l'Irrigation (RIS), 4) Approvisionnement Relatif en l'Eau (RWS), 5) Déficit en l'Eau des Cultures (CWD), 6) Déficit Relatif en l'Eau (RWD), 7) Consommation d'Eau (WC), 8) Rendement de la Production (Y), et 9) Superficie Totale Cultivée (TCA).

IPON a les principales fonctionnalités suivantes : l'analyse spatiale et temporelle, la visualisation, la représentation graphique et tabulaire et le téléchargement des données des indicateurs de performance de l'irrigation, déterminés à partir de la base de données WaPOR et des images de télédétection, pour les cultures de riz et de la canne à sucre.



Ecran de capture de l'Outil IPON

(Interface de l'indicateur de la Productivité de l'Eau WP)

Status

IPON permettra à l'Office du Niger, à moyen terme, d'améliorer la gestion et la productivité de l'eau et des terres sur son périmètre irrigué. Il servira aussi d'outil d'aide à décision pour les travaux d'entretien et de réhabilitation des infrastructures hydroagricoles.

IPON, dans sa version finale, a été remis à l'Office du Niger le 30 septembre 2025.

Un Comité technique composé de neuf (9) cadres de l'Office du Niger a été formé, pour l'exploitation, la maintenance et les besoins de mises à jour de l'IPON, en Août-Septembre 2025 par IWMI dans le cadre du codéveloppement l'outil.

Cérémonie solennelle de la remise officielle de l'Outil IPON à l'Office du Niger, Ségou, le 30 Sept 2025

De la gauche vers la droite :

- Mr Sander SWART, Senior Researcher Water & Climate de IWMI
- Mr Badara Aliou TRAORE, PDG de l'Office du Niger
- Mme Virginie GILLET, Responsable du Projet WaPOR chez FAO
- Mr Seriba KONARE, Représentant de la FAOML
- Mr Moctar DEMBELE, Chercheur chez IWMI

Irrigation Water Performance Assessment and Diagnostics Tool

Ahmad Alktout
Head of GIS Department
JORDAN VALEY AUTHORITY
Ministry of Water and Irrigation / JORDAN

Jordan Valley Authority (JVA)/ Ministry Of Water and Irrigation of Jordan (MWI)

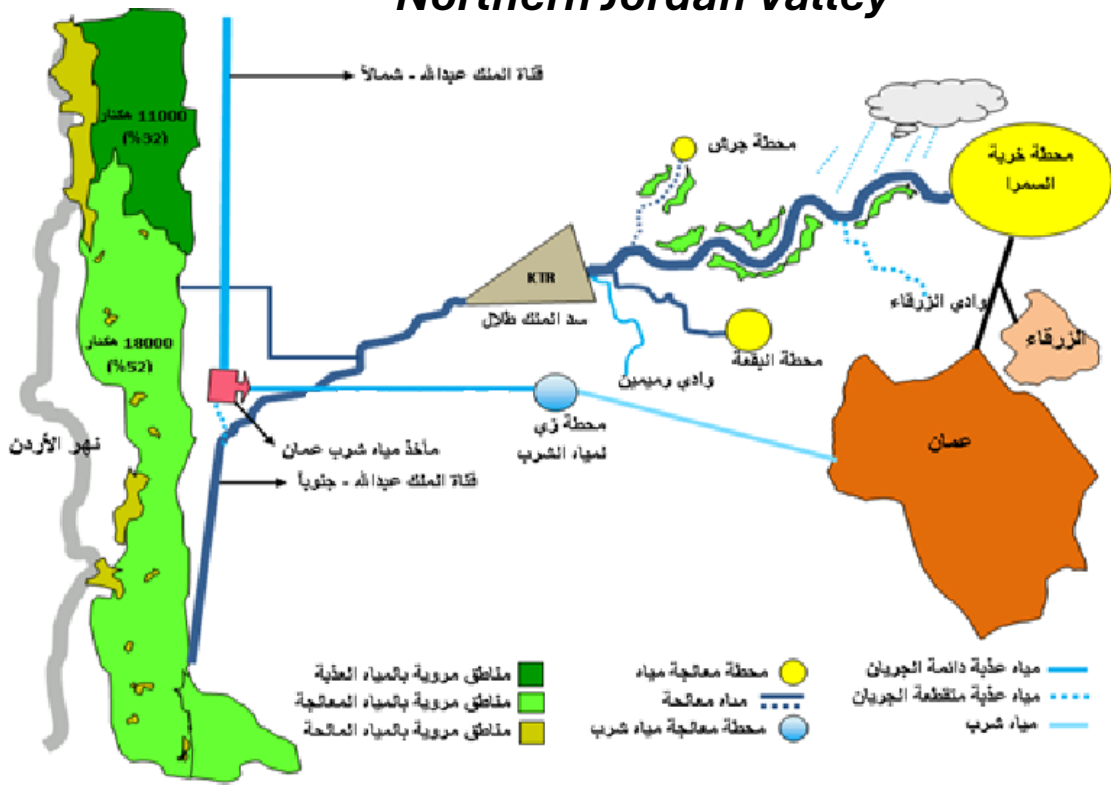
Mandate: Management of irrigation schemes and optimization of water use for agricultural production.

Irrigation Scheme Overview

- *Area: 10,000 hectares*
- *Farmers: 2,800 farmers*
- *Seasons: May to November*

Major Crops: 90% Citrus, vegetables, and Banana

Northern Jordan Valley



Irrigation Water Performance Assessment and Diagnostics Tool

Remote Sensing–Based Irrigation Water Performance Assessment and Diagnostics Tool Developed within the WaPOR

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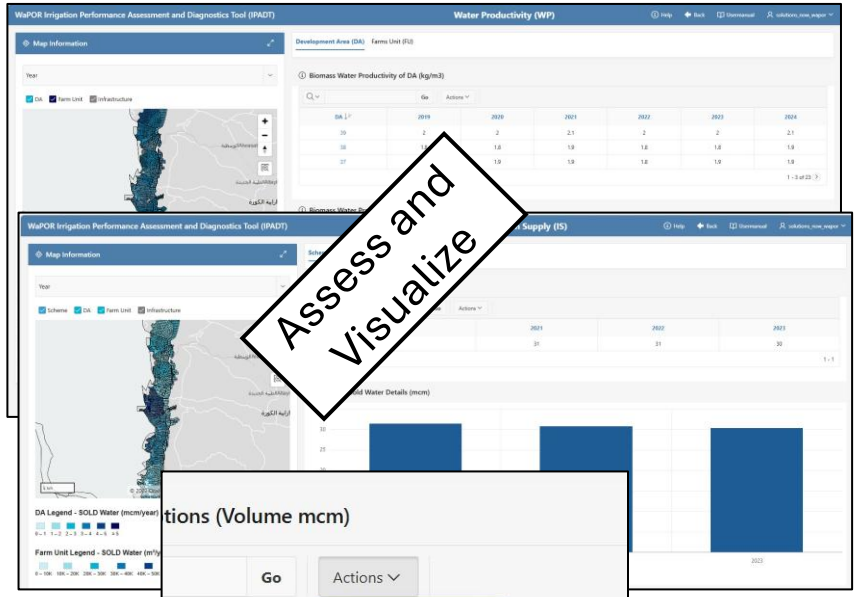
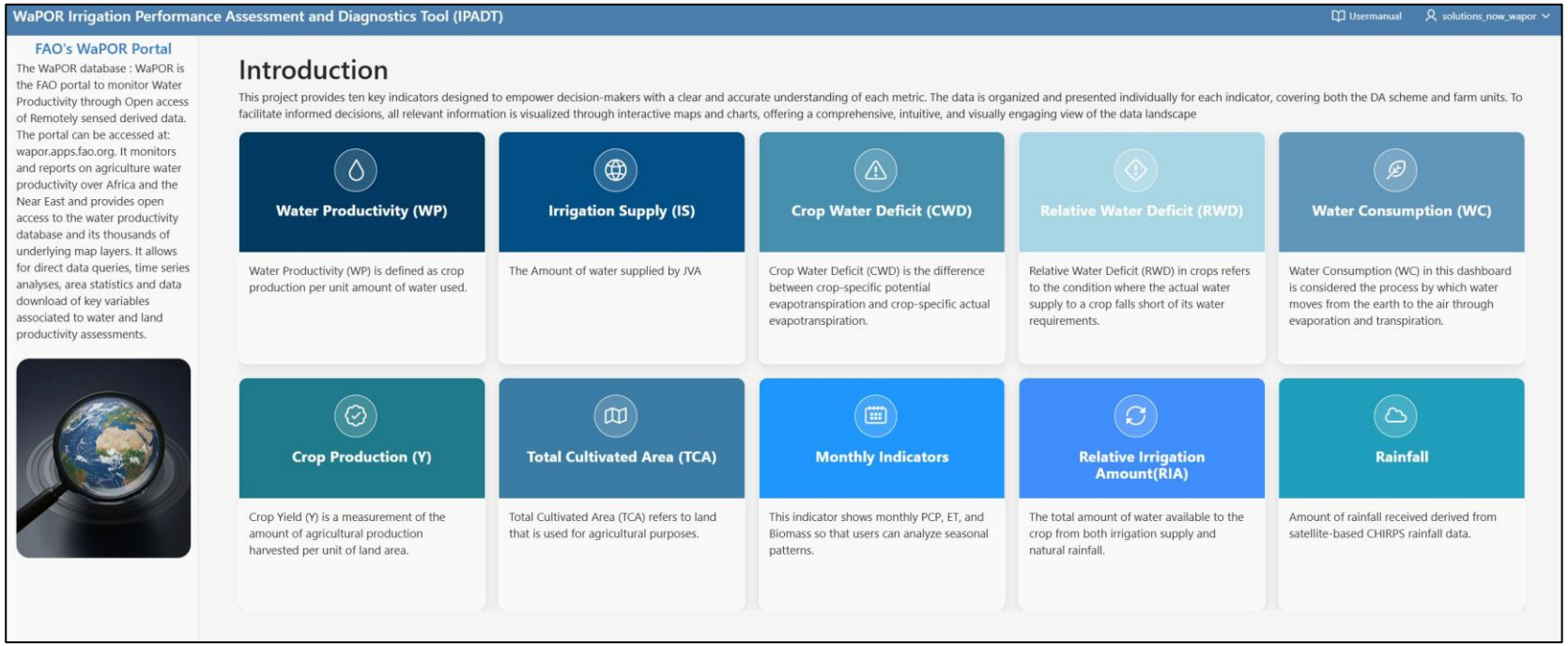


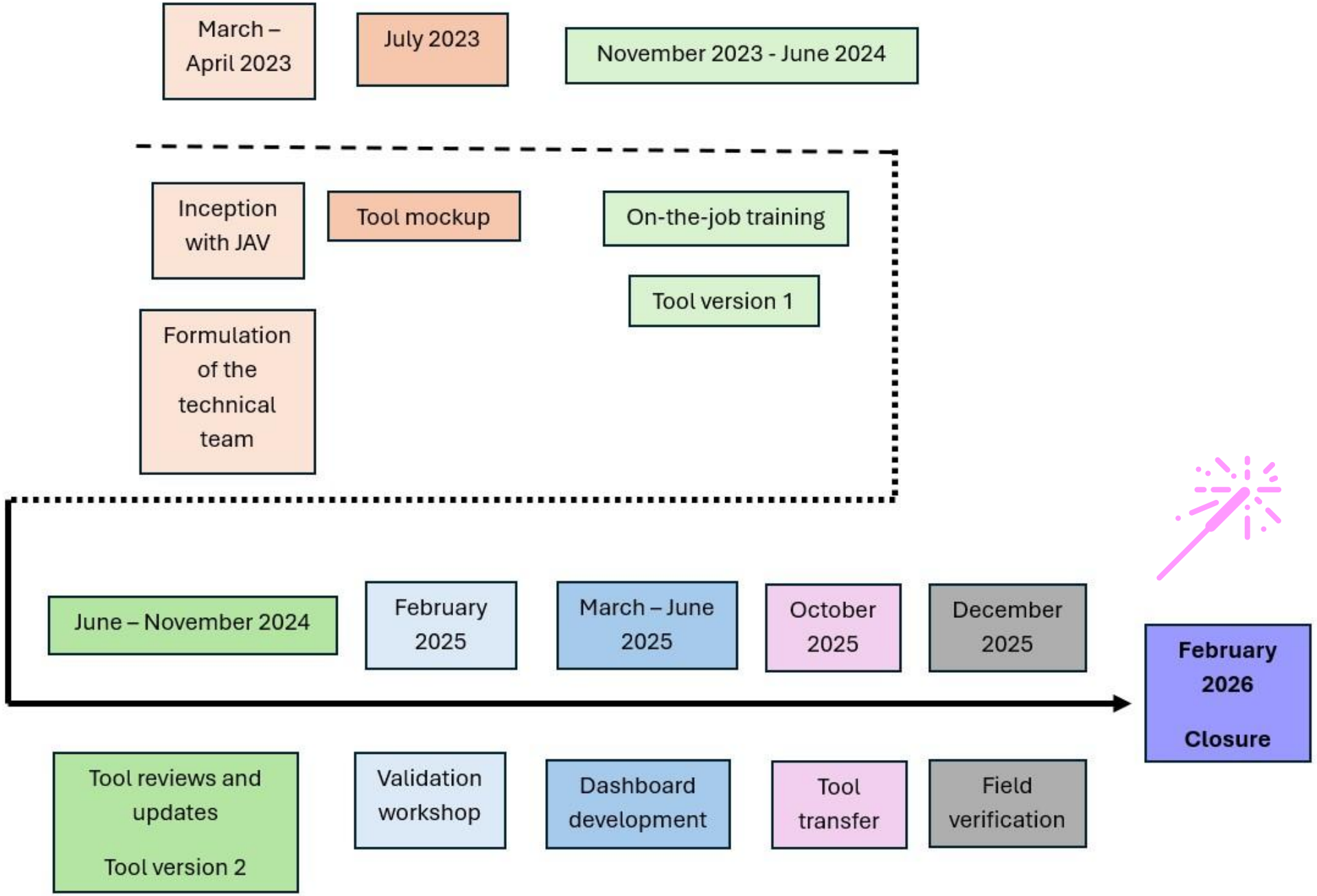
Indicators



Functionalities (assess, visualize, download, etc.)

International Water Management Institute

Status


March – April 2023
July 2023
November 2023 - June 2024
Inception with JAV
Tool mockup
On-the-job training
Tool version 1
Formulation of the technical team
June – November 2024
February 2025
March – June 2025
October 2025
December 2025
February 2026
Closure
Tool reviews and updates
Tool version 2
Validation workshop
Dashboard development
Tool transfer
Field verification

Water Consumption Dashboards

Fatiha Choukri
Head of IT Service

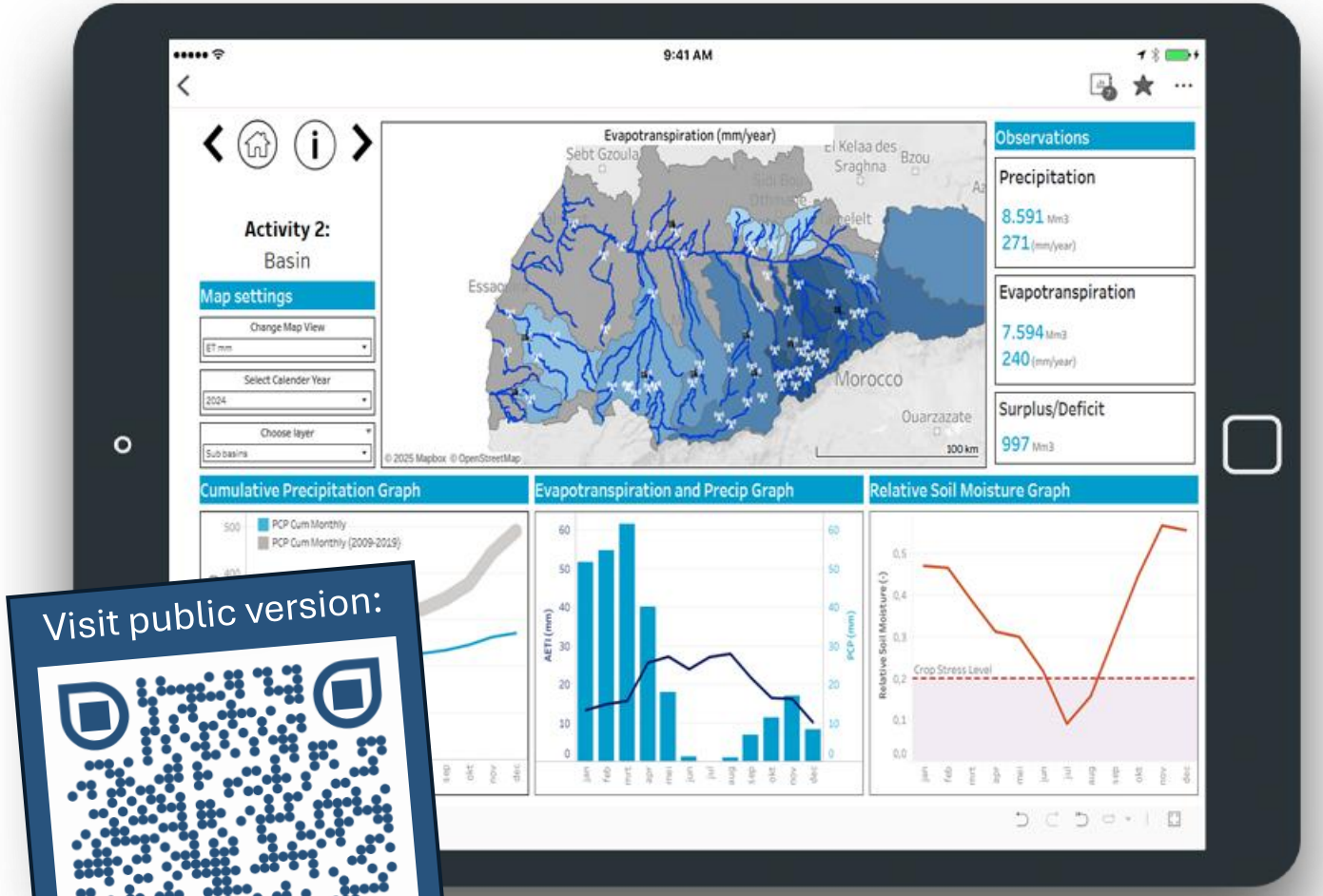
وكالة الحوض المائي لتانسيفت
Agence du Bassin Hydraulique du Tensift

Agence du Bassin Hydraulique du Tensift (ABHT)

Tensift Basin Agency

- In charge of planning, management (allocation) and monitoring / control of water resources in the Tensift basin (~26.000 km2)
- Extensive network of hydro-meteorologic and piezometric stations
- Complementary observation through indirect methods using satellite-based data and applications -> Evapotranspiration (WAPOR) and Precipitation (CHIRPS)

-> Spatial and temporal distributed monitoring of water balance parameters on basin, watershed, administrative or irrigation scheme levels



Visit public version:

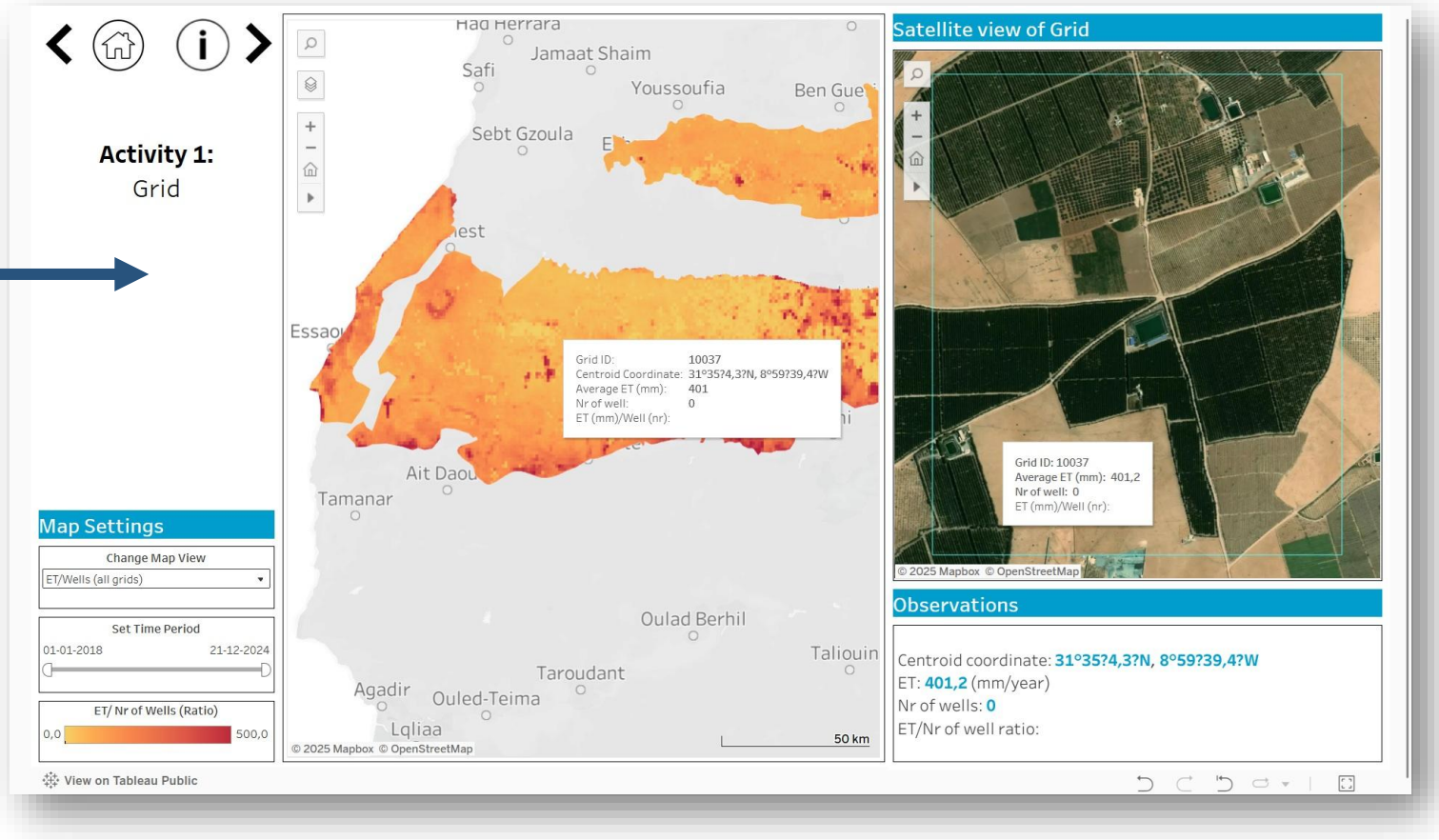
Water Consumption Dashboards

Assessed indicators:

- Evapotranspiration (mm/ha), Water productivity (kg/m3), Crop water deficit (mm/ha)

Example groundwater abstractions:

- Quickly identify areas where water consumption (ET) is high and few wells are registered
- Verify the reality of the terrain on the satellite image
- Direct the water police to the terrain, update the register of wells or file a complaint



Status

Support to:

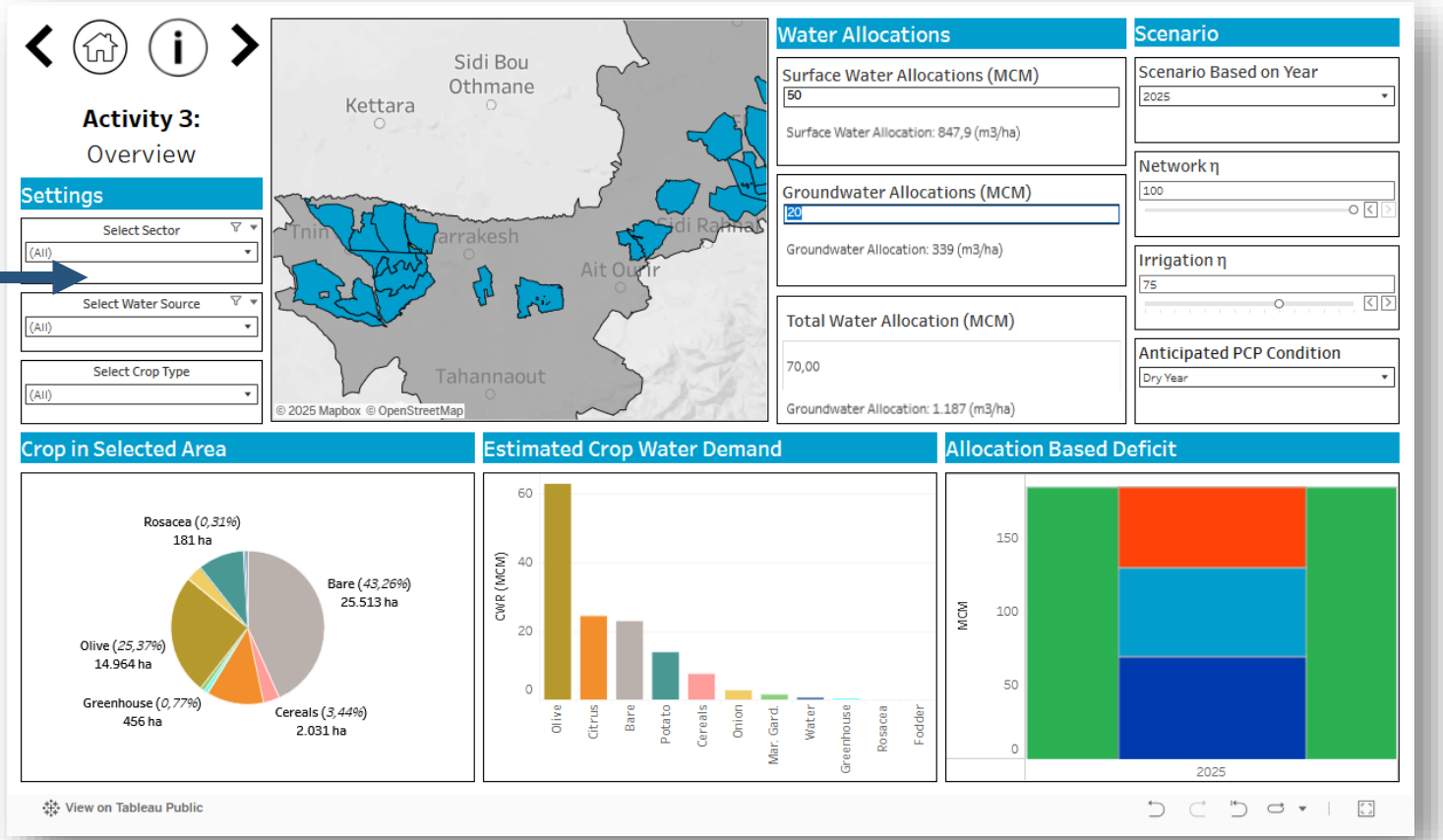
- Support for advisory services
- Monitor dynamics, assess impact of interventions and improve planning

Example water allocation planning:

- Compare estimated crop water demand per irrigation sector with available surface and groundwater allocations
- Find optimum allocation by running scenarios for different rainfall conditions, efficiency considerations and prioritized crops

Status:

- Dashboards developed and handed over, staff trained, need for continuous support



Irrigation Performance Assessment Tool in Mozambique Developed by International Water Management Institute (IWMI) and FAO

Delfim Vilissa
Director General _National Institute of Irrigation

Director of National Irrigation Institute

Organization: National Institute of Irrigation (INIR)

Location: Maputo, Bairro de Maxaquene "C", Rua 3253, n° 134; info@inir.gov.mz;

INIR is a public institution created by the Government of Mozambique under the Ministry of Agriculture and Rural Development (MADER) in 2012 through Decree n.º 09/2012, de 11 de Maio.

Mandate: Formulate policies, strategies, rules, formulate plans and conduct studies in the context of sustainable irrigation;

Irrigation Scheme Description: The Lower Limpopo area includes multiple schemes totaling 103,488 potential hectares, but only **45,000 hectares** are currently irrigated. It benefits 21,000 farmers across 56 water user associations. Key challenges: low land utilization, poor drainage, low irrigation efficiency, ineffective water charge collection, and salinization. Performance evaluation provides insights for improving efficiency, sustainability, optimal water use, and agricultural production to meet strategic water management objectives

Irrigation Performance Assessment Tool in Mozambique

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Irrigation performance indicators that are assessed

- ❑ Crop water requirement
- ❑ Crop water consumption
- ❑ Crop production yield
- ❑ Economic water productivity
- ❑ System efficiency
- ❑ Crop type mapping

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Irrigation Performance Assessment Tool in Mozambique

Functionalities:

- Assess, visualize, and download irrigation performance indicators.
- Online functionality: Mainly for INIR at Lower Basin Limpopo.
- Offline functionality: For field-level use in Lower Limpopo irrigation schemes.
- Back-end/front-end developed separately initially, with user involvement from the start to ensure suitable UI, indicators, and visualizations.
- Simple user interface: Accessible without programming or remote sensing skills;
- Help guideline: Included for step-by-step access to indicators.
- **Lead Institute**: INIR leads the process and back-end analysis, with IWMI support for development and on-the-job training to build INIR's capacity.

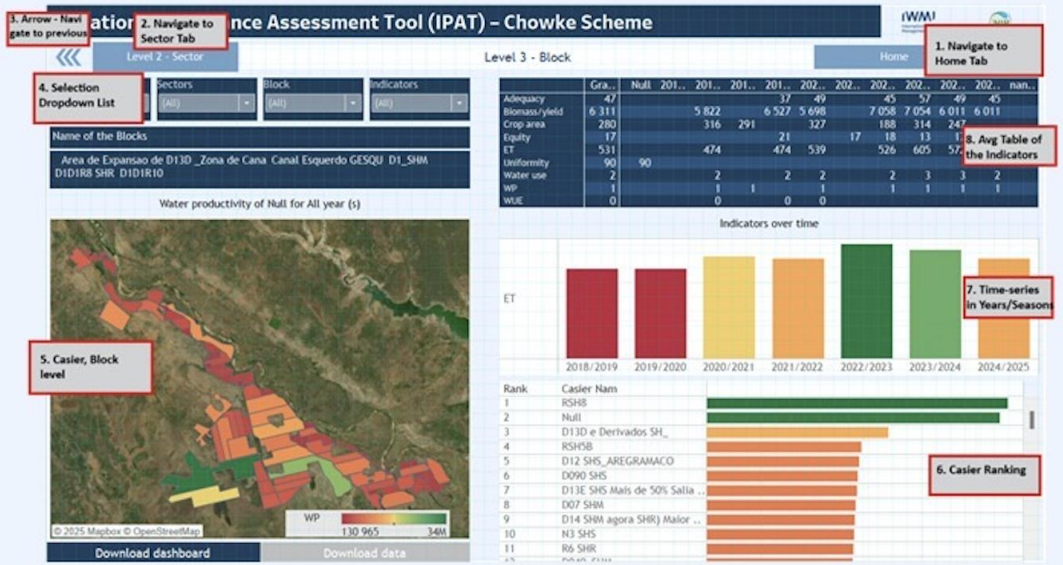
Irrigation Performance Assessment Tool in Mozambique

Irrigation Performance Assessment Tool (IPAT) – Chowke Scheme

IWMI International Water Management Institute

INIR

Management questions | How to use IPADT | Disclaimer



Dashboard components and functionality

1. Intro
provides an overview of the IPAT dashboard, its purpose, and key highlights. It also includes menu buttons for navigating to the main pages Scheme, Sectors, and Blocks allowing users to click any button to explore detailed performance at different levels.

2. Chokwe Scheme
Provides a description of the scheme's location, management, irrigation system, and command area. It highlights agro-climatic conditions, current productivity, and key challenges such as waterlogging, salinity, uneven water delivery, and flood damage, giving users context before exploring performance at sector and block levels.

3. Irrigation performance indicators description
Provides a detailed description of each indicator used in the IPAT dashboard. It explains what each indicator measures, how it is calculated, and its relevance for assessing irrigation efficiency, productivity, and resource use across the scheme, sectors, and blocks.

4. Management Questions
Connects the user needs to the right irrigation performance indicators. Click on indicators to navigate.

5. How to use
Provides step-by-step guidance on navigating and interacting with the IPAT dashboard. It explains how to apply filters, use menu buttons, and access detailed performance data at the scheme, sector, and block levels.

6. Disclaimer
Provides a note that IWMI and partners strive for accurate and complete data but are not liable for errors, omissions, or damages. Data and content may be updated or corrected at any time.

7. Main Pages (Scheme, Sector, Block)
These pages allow users to explore detailed irrigation performance at different levels:

Status

How does the tool support or will support your organization?

- Supports MAAP (including INIR, MRV and IIAM), and Lower Limpopo schemes in assessing irrigation performance, quantifying water consumption, evaluating crop yields, and informing decisions at national (policy/planning), tactical (water management), and operational levels.

what is the status? – handed over, under development

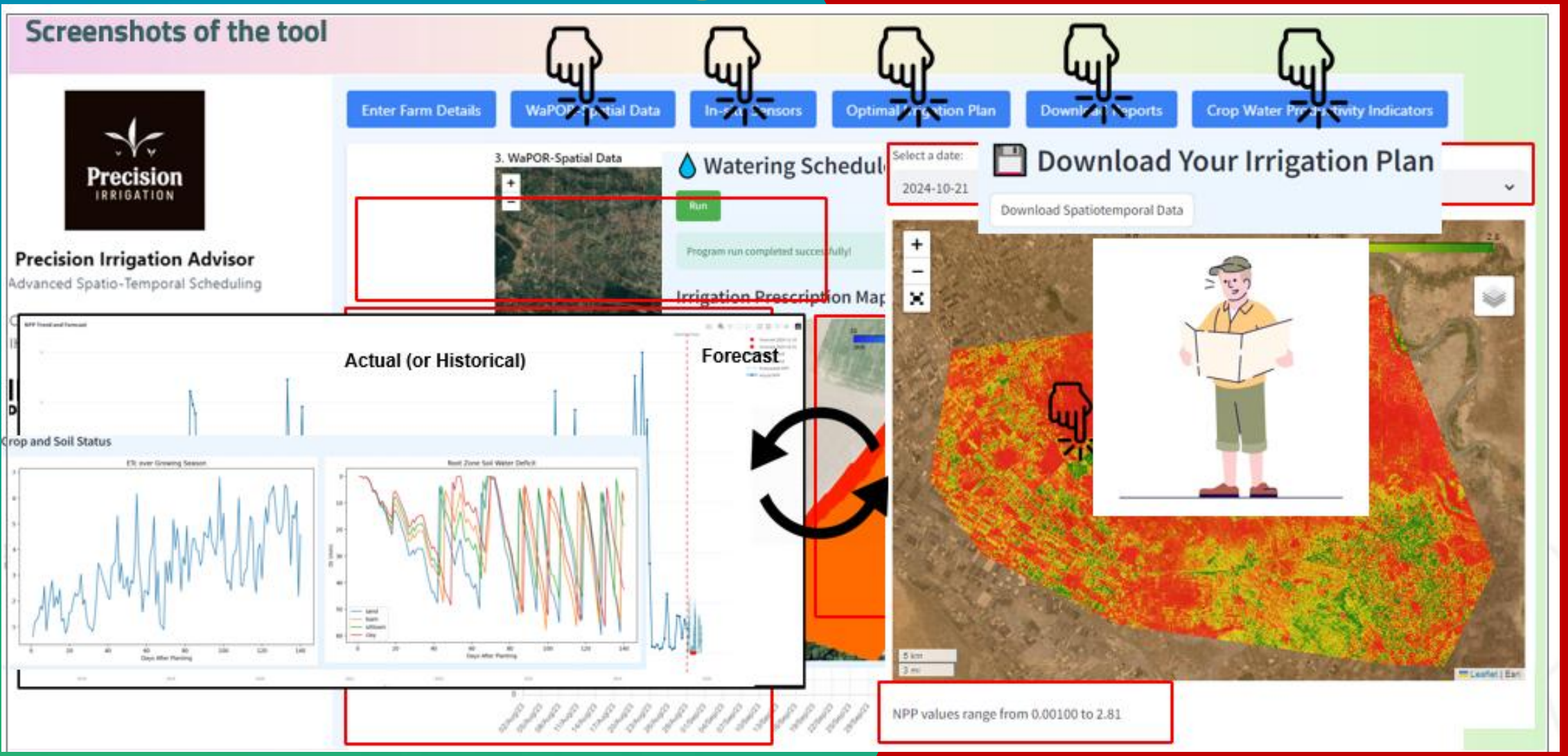
- Workshop held in September to present the IPAT Dashboard tool 2025
- Review of the tool and correction finished in November 2025
- Validation workshop and hand over to be hold in January 2025

Status

capacities developed, sustainability

- On-the-job training provided by IWMI on data processing, python chains for indicators, and tool use for INIR/MAAP.
- Capacity building in geospatial data via IHE modules; tool tutorial developed for ongoing use.
- Sustainability ensured through INIR hosting, stakeholder engagement, and data sharing protocols.
- **Challenges addressed**: Skill gaps bridged via training; data requests streamlined (1-15 days processing).

Precision irrigation advisor-Kenya



Eng. Jairus Serede

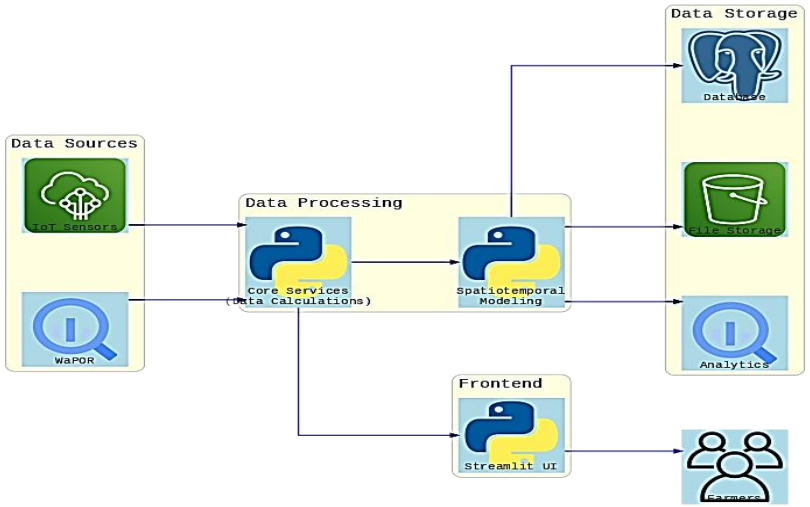
Director Irrigation Management Services-NIA

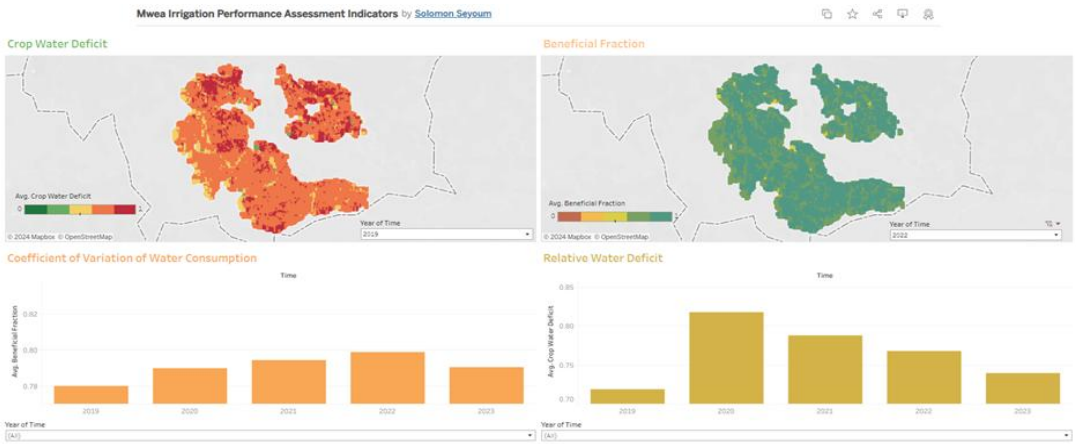
Kenya: **Precision irrigation advisor**

Ministry of Water, Sanitation and Irrigation
Mandate of NIA

1) Develop and manage national irrigation infrastructure
2) Support counties, smallholders, and private irrigation schemes
3) Provide technical design, construction, and O&M services
4) Strengthen IWUAs
5) Mobilize funding for irrigation projects
6) Promote water harvesting, storage, and reuse
7) Support market linkages and value addition
8) Conduct research and advise on fair agricultural prices
9) Coordinate irrigation stakeholders nationally and in counties

Kenya: **Precision irrigation advisor**





Features and description

Indicators Assessed

- ➢ ET (20 m), NDVI, soil moisture
- ➢ Crop water needs & water productivity

Functionalities

- ❑ Assess (WaPOR + sensors)
- ❑ Visualize (dashboards)
- ❑ Download (plans/reports)

Support to Organization

- ✓ Better irrigation planning in Mwea, Tana, Bura
- ✓ Data-driven decisions for NIA & farmers

Status

- ○ Under development; pilots & training ongoing (2024–2025)

Capacity & Sustainability

- ❖ NIA/MoWSI/JKUAT staff trained
- ❖ Tool transitioning to NIA for long-term management

Other tools released by IWMI-WAD

Core Indicators

- ❖ Water availability (rainfall, recharge, accounting)
- ❖ Water demand (crop needs; irrigated vs rainfed)
- ❖ Storage potential (1,000 m^3 pond sites)
- ❖ Sufficiency (demand–supply balance)

Functions

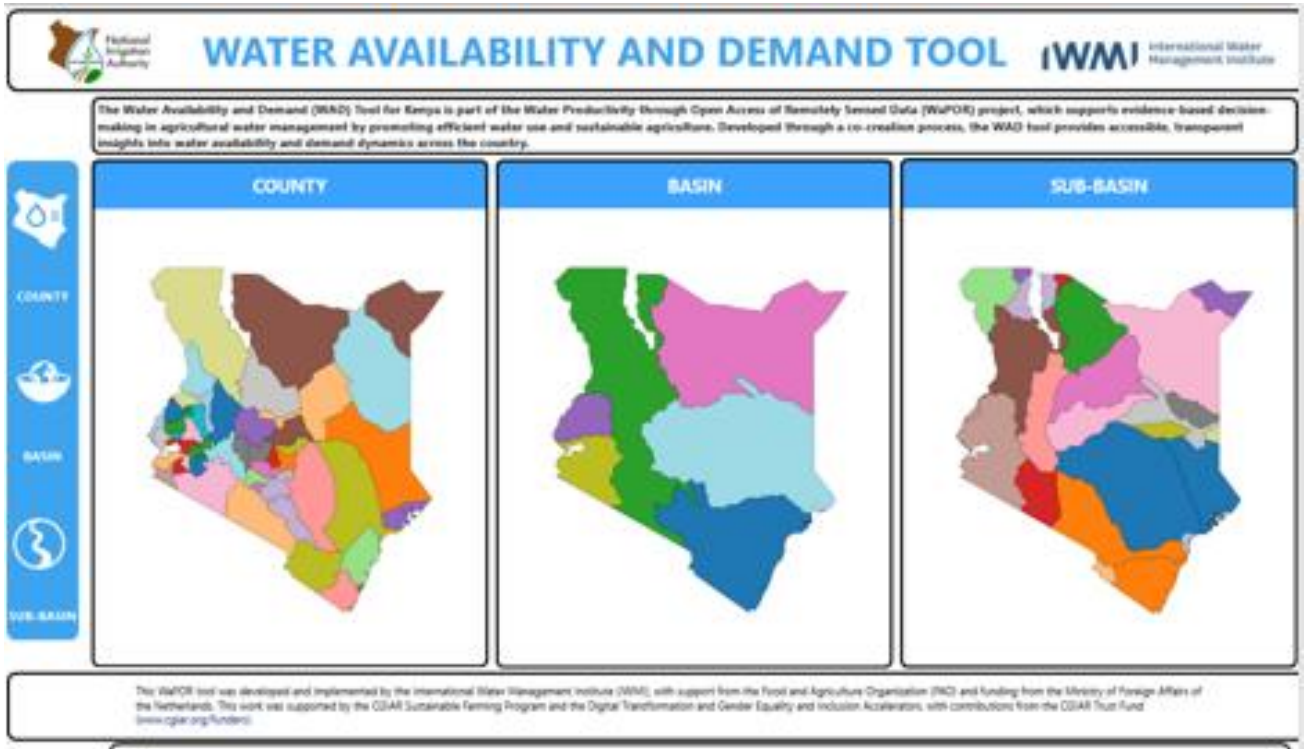
- ❑ Assess resources
- ❑ Visualize via maps & charts
- ❑ Download data & outputs

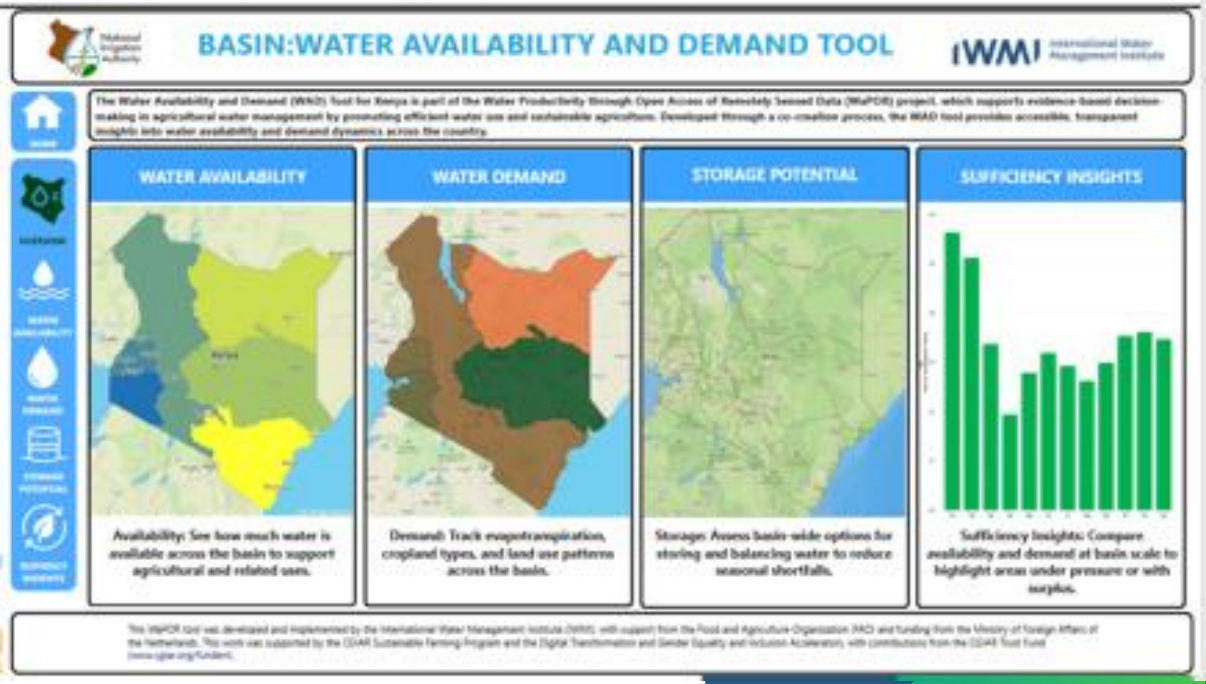
Why It Matters (NIA)

- ✓ Informs planning
- ✓ Quantifies crop water needs
- ✓ Supports sustainable irrigation expansion

Status & Sustainability

- ➢ Handed over **21 Nov 2025**
- ➢ NIA staff fully trained
- ➢ Standard workflows (QGIS, Colab, GitHub)
- ➢ Integrated into NIA planning systems





Panel discussion

What are the challenges in decision making in your organization and how does the tool address data gaps and supports informed decision-making?

How is the tool being used or going to be used and by whom within the organization?