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IMPROVING WATER USE EFFICIENCY IN JORDAN

Jordan, one of the world's most water-stressed countries, uses FAO's WaPOR portal to improve the efficiency and fairness of water distribution, supporting food and water security, rural livelihoods and climate resilience. WaPOR also contributes to GEO flagship GEOGLAM.



THE CHALLENGE

Jordan is classified as one of the most water-scarce countries in the world with available resources of only 61m^3 per capita per annum compared to a global average of around 5,400m^3 (i.e. 88 times more). This must meet the needs of individual citizens as well as those for agriculture and industry. As a guide, international institutions consider that 500m^3 is the extreme water scarcity threshold. Jordan is one of the poorest countries in terms of conventional renewable available water resources

Jordan's water supply comes from a combination of groundwater (57%), surface water (26%), and treated wastewater (17%*) . Sharing this resource between citizens, agriculture and industry and balancing the demand is a difficult task for which the Jordan Ministry of Water and Irrigation** is overall responsible.

Higher priority is always given to municipal water supply as it relates to survival and human well-being. Driven by a growing population, municipal water consumption has increased continuously over the years, leading to increased pressure on use by agriculture. Today, 97% of Jordans' water is either for municipal use or for agriculture.

To offset reducing supply and to cope with growing demand, new resources will come from desalinated sea water, contributing around 40% of water supplies in 2040. Even so, this is expected only to maintain the current level of water available of 61m^3 per person.

Whereas municipalities are almost wholly served using a combination of ground and surface water, agriculture irrigation is served 39% with water coming from groundwater, 30% from surface water, and 31% from reclaimed water. Jordan's low rainfall levels mean that 92% of the country is considered arid to semi-arid, receiving less than 200 mm of rainfall annually hence the importance of irrigation for the agriculture sector.

Significantly, a supply deficit for irrigation purposes of up to 38% is foreseen in the period up to 2040*** and it will be essential to continue exerting all efforts to increase demand management efficiency by improving water use practices and by minimizing water losses throughout the water systems.

*Ministry of Water & Irrigation, Water Budget 2024, Table 11

** National Water Strategy, 2023-2040.

*** National Water Strategy p33.

More information on **www.sebs360.eu**

WHERE DOES THE WATER COME FROM?

Jordan's surface water resources originate primarily from the transboundary Yarmouk river which provides some 45% of the total and the domestically sourced Zarqa River which provides 20-30%. The latter is particularly important as it is entirely under Jordanian control, rising from springs and runoff in the Highlands northeast of Amman, near the area of Zarqa, from which it takes its name. Both flow into the Jordan which is itself served by Lake Tiberis. Seasonal rainfall runoff captured in wadis, and a network of dams are used to store winter precipitation. However, declining rainfall, upstream water withdrawals, and increasing demand have significantly reduced the reliability of these resources. Furthermore, sediment build up in the dams is reducing the storage capacity whilst some 25% of Jordan's surface water originates from other countries meaning it is conditional upon international agreements.

MATCHING DEMAND WITH SUPPLY

Ensuring a fair and sustainable allocation of water for agriculture and industry is a key role of the **Jordan Valley Authority (JVA)**. The JVA manages bulk water resources, transboundary water infrastructure, dams and water-harvesting initiatives, as well as agricultural and land development and infrastructure in the Jordan Valley. It works closely with the **Water Authority of Jordan (WAJ)**, which is responsible for supplying water to citizens and some agricultural users. Domestic supply has priority, with the JVA responsible for allocating the remaining water among farms and agricultural users within its area of responsibility.

Jordan's water resources face increasing pressure from several factors:

- **Population growth**: Jordan's population was around 11 million in 2021 and is projected to reach approximately 17 million by 2040. Population growth has also been influenced by migration resulting from regional conflicts, including displacement from Syria.
- **Declining water resources**: Falling aquifer levels are forcing groundwater abstraction towards the highlands, increasing pressure on available resources and the risk of pollution.
- **Geostrategic pressures**: Jordan depends partly on shared water resources and agreements with neighbouring countries, including Syria and Saudi Arabia. Around 25% of surface water originates outside Jordan, making transboundary water management particularly important.
- **Climate change**: Rising temperatures and declining rainfall are expected to reduce surface-water availability by around 15% by 2040.

Against this background, **wastewater is increasingly regarded as a strategic water resource** alongside groundwater, surface water and future desalination. The National Conveyance Project (NCP) is intended to expand water-treatment capacity through 2035. Treated wastewater already provides approximately one-fifth of Jordan's usable water supply and could become one of the country's largest and most reliable water resources, potentially accounting for around one-quarter to one-third of available water by the mid-2030s.

UNDERSTANDING AND ADDRESSING THE PROBLEM

With a limited water budget, the challenge for the JVA is to ensure the maximum efficiency of use by the agriculture sector. In the Jordan valley, 70–90% of crop water needs must often be supplied through irrigation. Agriculture contributes 5-6% to the Jordan economy but this does not reflect the strategic value to the Kingdom.

Despite its modest contribution to the GDP, agriculture is an important sector in Jordan due to its role in water security and in providing the country with large volumes of the domestic food needs, especially fresh fruits and vegetables, and its role in employment and income creation. Jordan's agriculture is dominated by vegetables, olives, dates and citrus. For exports, the standout products are fresh vegetables and Medjool dates, while domestic food security relies heavily on vegetables, olive oil, poultry, and imported cereals supplemented by local produce.

Agriculture is considered one of the main sources of income for about 80,000 families in Jordan's rural areas providing approximately 10% of total employment. Additionally, agriculture serves an important role in preserving biodiversity, vegetation, and soil properties.

The GEO Work Programme Activity

GEOGLAM (Global Agricultural Monitoring Initiative) is an international partnership that uses Earth Observation to monitor global agricultural production. It was established under GEO to improve transparency and coordination in global food security monitoring. GEOGLAM provides near-real-time information on crop conditions, yields, and drought impacts using satellite data and ground observations. It supports early warning systems for food crises by helping governments and international organisations anticipate supply risks.

GEOGLAM
GLOBAL AGRICULTURAL MONITORING

https://geoglam.org/

HOW SATELLITES CAN HELP

WaPOR (Water Productivity through Open access of Remotely sensed derived data)* is a global tool developed by the FAO. IHE Delft and the International Water Management Institute (IWMI) are partners to the project along with 13 countries**. WaPOR uses satellite Earth Observation data to provide near real-time information on land and water resources. It is hosted on the FAO Agro-informatics platform and is freely available to all countries wishing to improve the management of their agriculture land and water resources. FAO through WaPOR and other initiatives, is actively involved in GEOGLAM, a GEO flagship which focuses on EO for agriculture monitoring. WaPOR data and tools are also accessible through the GEO Open Knowledge Hub. Project activities focus on the demand-driven development of the capacity of the 13 partners to use satellite data to improve their management and use of land and water resources in agriculture. WaPOR uses satellite observations to generate regularly updated information on:

- Actual evapotranspiration (water consumed by crops)
- Biomass production
- Crop water productivity
- Irrigated area mapping
- Drought and water stress indicators

The JVA has used WaPOR as the basis for the Irrigation Performance Assessment and Diagnostics Tool (IPADT)*** to calculate crop water consumption and productivity. The tool also provides a set of performance indicators – including consumption uniformity, equity, adequacy, water productivity and efficiency – that help decision-makers and irrigation managers enhance irrigation performance.

Because the data is derived from satellites, it can cover entire river basins, irrigation districts, and countries consistently, including areas where ground measurements are limited and at different scales 20m, 100m and 300m. Data is available for every 10 days, monthly, seasonally or yearly.

Copernicus Sentinel data is an important and growing component of WaPOR. Originally developed using Landsat and Modis data, Sentinel 2 and Sentinel 3 data now provide the backbone of the service by offering the higher resolution and wider and more frequent coverage needed to improve irrigation management, crop monitoring, and water productivity assessment in water-scarce countries such as Jordan.



Figure 2: WaPOR browser at https://data.apps.fao.org/wapor

* WaPOR flyer https://openknowledge.fao.org/items/04fcf6d4-0077-48a0-ac54-14f164e93b58
**Algeria, Colombia, Egypt, Ethiopia, Iraq, Jordan, Kenya, Mali, Mozambique, Pakistan, Palestine, Sudan and Tunisia.
***IPADT Jordan https://www.fao.org/in-action/remote-sensing-for-water-productivity/applications and-uses/applications-catalogue/product-detail/irrigation-performance-assessment-and-diagnostics tool-(ipadt)

The satellite data



Sentinel-2 carries an innovative wide swath high-resolution multispectral imager with 13 spectral bands. The combination of high resolution, novel spectral capabilities, a swath width of 290 km and frequent revisit times provides unprecedented views of Earth.

Copernicus Sentinels data are available under an open and free data policy.

Sentinel data can be accessed at

https://dataspace.copernicus.eu

More info:

https://sentinels.copernicus.eu

The Service Provider

The International Water Management Institute (IWMI) was established in 1984 with its headquarters in Sri Lanka. The Institute has the goal to to drive global transformation in water management, supporting informed decision-making from grassroots communities to international policy forums.

Based on evidence and knowledge drawn from our science, innovative technologies and testing of business models, IWMI works with governments, policymakers, farmers, civil society, water managers, development partners and businesses to solve water problems and scale up solutions.

IWMI is a partner to FAO which has developed the WaPOR tool.

IWMI International Water Management Institute

https.iwmi.org



Figure 4: A training field trip for the IPADT in the Jordan Valley. Credits: FAO.

WHO IS CONCERNED?

Water scarcity is a national priority in Jordan and affects a wide range of stakeholders. Overall responsibility for water policy rests with the Ministry of Water and Irrigation, which has set out a long-term vision in the National Water Strategy 2023–2040. The strategy recognizes that Jordan's limited freshwater resources can no longer meet growing demand and calls for a transition towards more efficient water use, greater reliance on non-conventional water sources, and improved management of agricultural water consumption.

Key public institutions include the **Water Authority of Jordan** (WAJ), responsible for municipal water supply and wastewater services, and the **Jordan Valley Authority** (JVA), which manages irrigation water and agricultural development in the Jordan Valley. Together, these organizations face the challenge of balancing the competing needs of households, industry, agriculture, and the environment.

The agricultural sector is particularly concerned, especially through the involvement of the **Ministry of Agriculture** and the **National Agriculture Research Centre** (NARC), as it accounts for the largest share of water use while operating under increasing resource constraints. Farmers, agri-businesses, Water User Associations, and agricultural cooperatives are therefore central to the implementation of more efficient irrigation systems, the adoption of lower-water-demand crops, and innovative production methods such as greenhouse cultivation and hydroponics.

Water utilities, local authorities, community leaders, and civil society organizations also have important roles in ensuring equitable access to water and supporting public acceptance of reforms. Success will depend on close collaboration across all stakeholders to achieve the strategic objectives of reducing water losses, improving agricultural water productivity, expanding the use of treated wastewater, ensuring transparent and equitable water allocation, and reducing illegal abstractions. Together, these measures are essential to strengthening Jordan's water security, supporting economic development, and building resilience to climate change.

The Service Enabler

The Food and Agriculture Organization (FAO) is a specialised agency of the United Nations that leads international efforts to combat hunger and improve food security. It works with governments to develop sustainable agriculture, fisheries, and forestry practices worldwide. FAO provides technical expertise, data, and policy guidance to help countries manage natural resources, including water and land. It plays a key role in promoting climate-resilient agriculture and improving efficiency in food production systems. FAO also supports global monitoring tools such as WaPOR to help countries optimise water use in agriculture.

Food and Agriculture Organization of the United Nations

www.fao.org

The Primary User

The Jordan Valley Authority (JVA) is a Jordanian government agency responsible for the development, management, and protection of the Jordan Valley, one of the country's most strategically important agricultural and water-resource regions.

JVA was established in 1977 and operates under the Ministry of Water and Irrigation. JVA manages, and protects water and land resources and their supporting infrastructure in the Jordan Valley in an environmentally and economically sound manner, in the Jordanian national interest, through creating partnership with the private sector where appropriate.

https://grc-jordan.org/info_card/jordan-valley-authority/

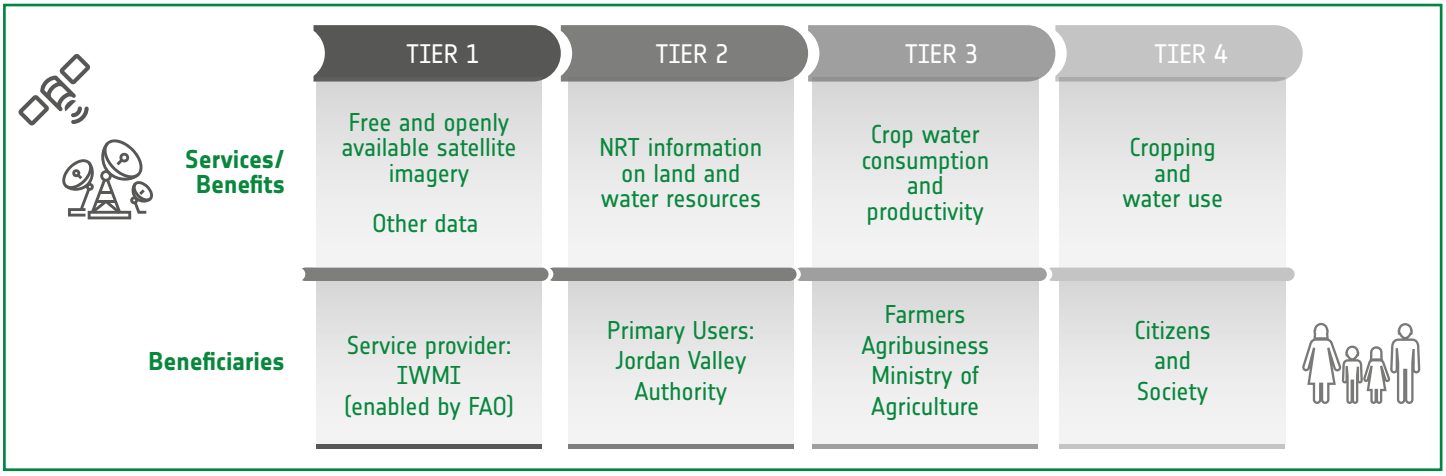


Figure 3: Value chain of the main stakeholders and beneficiaries

WHAT ARE THE BENEFITS?

Jordan has substantially improved water-use efficiency over the past two decades through expanded wastewater reuse, modern irrigation techniques, and investments in water conservation. Nevertheless, these gains have largely been offset by growing demand, groundwater depletion, and climate change. As a result, improving water productivity — producing more agricultural production (yield) from each cubic metre of water—remains a central objective of Jordan's water strategy WaPOR is a tool to support this objective which is yielding benefits in a number of different ways:

- **Better irrigation management**: WaPOR can identify fields or irrigation schemes where water use is unusually high relative to crop production. This allows authorities and farmers to improve irrigation scheduling and reduce waste.
- **Improved Water Allocation**: WaPOR will support the JVA to plan the allocation of irrigation water based on actual crop needs rather than speculative and traditional habitual requests without a substantiated basis.
- **Water productivity assessment**: Rather than simply measuring how much water is supplied, WaPOR helps answer the more important question; How much crop yield is produced per cubic metre of water consumed? This is critical in Jordan, where every cubic metre of water has a high economic value.
- **Crop strategy**: The JVA uses WaPOR data to monitor irrigation performance across the Jordan Valley, helping target infrastructure improvements, identify areas where water savings are possible, predict yields and help define a crop strategy.
- **Drought early warning**: WaPOR provides near real-time information on vegetation condition and water stress, supporting drought preparedness and response.
- **Groundwater protection**: By improving understanding of actual crop water consumption, WaPOR can help reduce pressure on overexploited aquifers and support more sustainable groundwater management.
- **Policy Assessment**: For national agencies such as the Ministry of Water and Irrigation and the Water Authority of Jordan, WaPOR can support:
  - Water allocation decisions
  - Agricultural planning
  - Climate adaptation strategies
  - Evaluation of irrigation investments
  - Monitoring progress toward water-efficiency targets
- **Use of Treated Water**: For example, citrus trees are sensitive to clean water contrasted with the planned increased use of treated water especially noting the National Carrier Project.
- **Detection of Illicit use**: WaPOR helps identify anomalous cropping and vegetation patterns arising from illegal water use.

The key benefits can be summarised as follows:

Economic

Increased efficiency of use of the scarce water resource giving improved yields and crop value for the supplied water. Increased or maintained supply through wastewater treatment and use.

Environmental

Better water management in Jordan delivers important environmental benefits by reducing groundwater depletion, improving river and wetland health, enhancing water quality, lowering energy consumption, and increasing resilience to climate change.

Regulatory

Better knowledge and control of water use for agriculture enables more precise regulation and control. Both JVA and WAJ can improve monitoring and evaluation of the National Water Strategy through the data from WaPOR and IAPDT. WaPOR supports governmental organisations responsible for managing water used in agriculture to gather the information they need to make better decisions.

Innovation and Entrepreneurship

WaPOR helps drive digitalisation of key processes within the Ministry as well as in the JVA.

Scientific/Knowledge

The University of Jordan has improved the general knowledge of agricultural use of water including illegal wells and problems with the irrigation system. It hosts the National Knowledge Hub for Land and Water Productivity at the Faculty of Agriculture which was established under WaPOR as a means to bring together modern information technology, geospatial analysis tools and dedicated training spaces and where researchers, students, and government professionals can learn, test, and co-create solutions using WaPOR. A new "Higher Diploma in Digital Management of Water Resources" has been accredited in June 2026 by the Ministry of Higher Education as a result of the collaboration with the WaPOR project.

Societal

The synoptic and consistent view of water resources in Jordan provided by Sentinel data helps build trust and reduce barriers to co-operation between different, often competing, actors. WaPOR generates evidence improving both transparency and fairness amongst the large number of users.



EXTENDED IMPACT

For Jordan, WaPOR is not simply a mapping tool; it is a water productivity management system. By showing where water is being consumed, how efficiently crops use it, and where improvements are possible, it helps decision-makers maximize agricultural output from one of the world's most limited water resources. In a country facing chronic water scarcity, even small improvements in irrigation efficiency can translate into significant water savings and greater longterm resilience.

As part of a co-ordinated effort with the FAO, with 13 other countries as well as the many partners in GEOGLAM, WaPOR is also enabling the spread of knowledge and technology improvements to further drive increasing efficiency in the water sector.



Figure 5: WaPOR Training in Jordan. Credits: FAO

"The integration of Sentinel data through WaPOR has transformed how we understand and manage water use in agriculture. It allows us to move from estimation to evidence, improving both efficiency and fairness in water distribution, which is critical in a water-scarce country like Jordan."

Ahmad Alktout, Head of GIS department, Jordan Valley Authority

ABOUT THE PROJECT

The SeBS4GEO project is a spin-off of the Sentinel Benefits Study (SeBS) and is conducted by EARSC (European Association of Remote Sensing Companies) for the European Space Agency (ESA). The project has the goal to support the GEO Work Programme Activities to showcase their benefits derived from the use of Sentinel data.

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The impact analysis of this case has been conducted in the context of the GIAT development and validation.
We acknowledge that the understanding of the case was supported by discussions with JVA Secretary General, Eng. Hesham Alhesa and Eng. Ahmad Alktout, Livia Peiser, Virginie Gillet and Nour Habjoka of the FAO. We thank them for their valuable insights and availability.

Do you know an interesting case demonstrating the benefits derived from the use of Sentinels data?

Email info@earsc.org

More Information on Sentinels Benefits Studies:

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The views expressed in this study cannot be taken to reflect the official position of the EU or of ESA.