IRRIGATION SYSTEM MANAGEMENT

Service summary and potential applications

To enhance global food security it is essential to increase food production through the use of irrigation. Improved water management holds the key to producing enough food for the world's population in 2030 (FAO). Achieving higher food production levels requires the expansion of irrigated area, improvement of crop productivity and irrigation efficiency.

Earth Observation (EO) technology supports the exploration of a country's or region's irrigation potential by providing reliable information on actual and potential water consumption as well as crop production. The crop water requirements estimates allow to determine the exact water amount needed by specific crops, which benefits crop productivity and irrigation efficiency and which identifies opportunities to expand irrigated area.

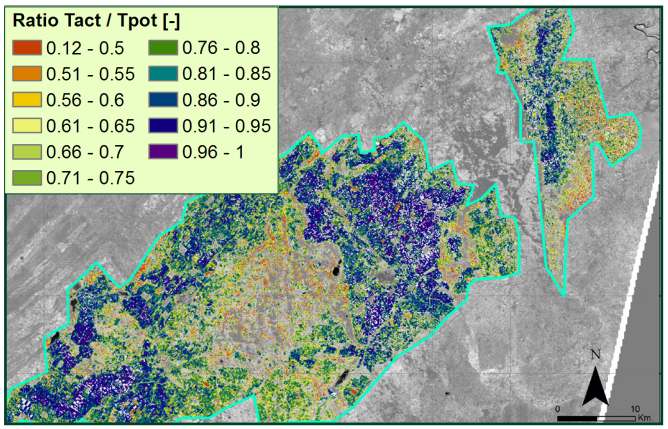
EO services can provide estimates of the already irrigated area, can identify land suitable for irrigation, and can estimate the impact of land use change on the water balance by comparing actual crop water use with irrigation water requirements. They are also used to monitor and evaluate irrigation schemes. A complete irrigation performance assessment requires field data that is often either hard or expensive to obtain. Derived indicators provide objective information on irrigation performance in data-scarce regions.

Indicators like evapotranspiration provide spatial insight into the water needs of an irrigation system, such information is required for optimal water distribution management. Irrigation managers can monitor crop water consumption within their area on a semi real-time basis, or alternatively they look at accumulated figures over an entire season, or analyse the spatial crop water consumption from year to year. This allows for precision farming at field and scheme scale.

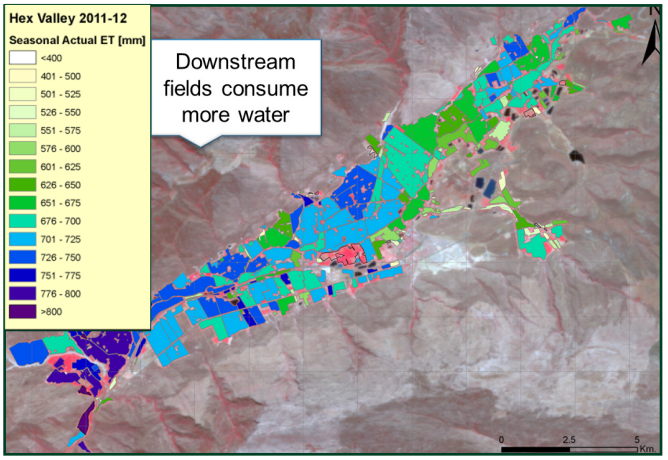
The combination of actual with potential evapotranspiration data and crop production data from satellite data is used to determine the crop water deficit – the amount of water that the crop lacks to grow optimally – and the water productivity – the crop production per unit of water, which is an indicator for production within and between irrigation schemes.

The illustrated example shows how irrigation authorities used the crop water stress – the ratio between the actual crop water use and the potential crop water use – as an indicator of water distribution in the Doukkala Scheme in Morocco. Crop water stress proved to be an insightful indicator to assess and explain variability and identify areas with high crop water stress, supporting the irrigation authority to redistribute water more equally.

The water trading principle integrates on-farm irrigation water requirements with off-farm water allocation realities. In most large-scale gravity irrigation systems, water is rotated per block according to a set schedule. The challenge is to optimize water allocation throughout the system, also at times of high irrigation demands. Currently, off-farm water managers lack timely insight in upcoming irrigation demands. This results in them turning down irrigation requests, and this leading to lower crop yields or even wilting crops in certain parts of the system. Satellite-derived crop water requirements provide actual on-farm water needs. With real-time insight into which parts of the system needs the water most urgently, water managers can consider the balance between water availability, irrigation demand and labour requirements. This leads to fair and impartial decisions regarding off-farm water allocation. Rather than having to turn down requests for irrigation water during peak demand periods, they can now offer the option to irrigate 1 or 2 days before the optimal irrigation time, with sufficient water to sustain crop production, improving yields considerably.



Spatial distribution of crop water stress within Doukkala irrigation system. The red boxes show areas with high water stress. Copyright: eLEAF



Irrigation management on scheme level to identify the areas that consume most water. An example from the FruitLook service in South Africa. Copyright: eLEAF

EO information services

Information service	Content / Products
Irrigation planner	» Advise on irrigation requirements by internet or mobile services based on actual crop water requirements and weather forecast
Selection of suitable areas for irrigation development	» Determine suitable areas (their potential and risks) taking into consideration the current land use and water consumption, irrigation water requirements, available water, consequences for the water balance, elevation and meteorology
Irrigation system design	» Knowledge on the amount of water needed by the crop (crop water requirements from evapotranspiration), elevation, and meteorological data provide the necessary tools for irrigation system design
Water Accounting	» This service estimates the impact of irrigation on the water balance
Water productivity	» Provides the yield or biomass water productivity (water actual consumed by the crop versus production) as a management and planning tool
Water auditing	» Alerting service that validates actual water consumption with the allocated water

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