

# Future-oriented technologies and services for a sustainable land management

I-WALAMAR – Water- und land management in Morocco



The Maghreb region, particularly Morocco's Fès-Meknès region (FMR), faces increasing challenges in water and food security. These issues are exacerbated by frequent seasonal droughts and unsustainable groundwater use. The olive oil sector, which accounts for almost 30% of Morocco's olive production, is particularly affected. The expansion of intensive and super-intensive olive plantations, along with the proliferation of modern and traditional oil mills, generates substantial volumes of wastewater and solid residues. These by-products contain high concentrations of organic matter and phenolic compounds, representing both an environmental problem and an opportunity for resource-efficient utilization. Against this background, the Moroccan-German research project I-WALAMAR was initiated to develop innovative solutions to improve resource efficiency and strengthen water and food security.

Within the I-WALAMAR project, several demonstration approaches were implemented in the Fès-Meknès region to promote resource-efficient use of olive oil by-products and sustainable water management in agriculture:

## Treatment and Reuse of Olive Oil Wastewater

Suitable treatment methods—including natural sedimentation, biological filters, and ceramic or clay-based membranes—were applied to purify olive oil wastewater so it

could be reused for agricultural irrigation. The aim was to significantly reduce organic pollutants and toxic phenolic compounds while retaining valuable nutrients in the cycle.

## Recovery of Valuable Compounds

Phenolic compounds were extracted using high-performance liquid chromatography (HPLC) and  $\beta$ -cyclodextrin. These compounds have high economic potential, for example as natural antioxidants in the food or cosmetics



industry.

### Energy Recovery from Residues

Organic solids from olive oil production were anaerobically digested to produce biogas. The resulting methane can be used as an energy source, while the digestate serves as a soil conditioner.

### Soil Improvement with Hydrogels

Biodegradable polyaspartic acid-based hydrogel soil additives were tested to enhance water retention in agricultural soils. This improved crop yields, particularly under semi-arid conditions.

### Digital Water Resource Management

Agro-meteorological stations and satellite-based remote sensing were integrated to better control water use. The WEAP model (Water Evaluation and Planning) was used to simulate water availability and resource management scenarios at the regional level.

### Project Goals

The goal of the I-WALAMAR project is to demonstrate innovative approaches for the reuse of olive mill wastewater and the resource-efficient utilization of organic residues in agriculture. By combining adapted water treatment methods, recovery of valuable compounds, and energy use of residuals, the project provides practical contributions to reducing environmental impacts and strengthening climate resilience in semi-arid regions.

A particular focus is on engaging local stakeholders and training professionals across the entire value chain – from wastewater treatment to agricultural application –ensuring long-term, sustainable implementation of the developed solutions.

## Project overview

### PROJECT TITLE

I-WALAMAR – Water- und land management in Morocco

### PROJECT PERIOD

07/2019 – 12/2022

### PROJECTPARTNERS

Bonn International Center for Conversion (BICC); Universität Hohenheim; Institut für Agrartechnik; Fg. Agrartechnik in den Tropen und Subtropen; FH Aachen; Institut für Angewandte Polymerchemie (IAP); Palaterra Betriebs- und Beteiligungsgesellschaft mbH; InnoAgri GmbH; SEBA Hydrometrie GmbH & Co. KG; + 8 weitere marokkanische Partner

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