Development and application of integrated technological and management solutions for wastewater treatment and efficient reuse in agriculture tailored to the needs of Mediterranean African Countries: the MADFORWATER project

Background

Mediterranean African Countries (MACs) face a relevant water crisis, due to low water availability per capita, insufficient rate of wastewater treatment, overexploitation of renewable water resources, high demand of water for agriculture and non-optimized irrigation practices. In the next decades, population and economic growth combined with climate change will make the situation even more dramatic, unless significant and rapid actions are taken. In response to this crisis, the general goal of the **MADFORWATER project** is developing integrated technological and management solutions to boost wastewater treatment and treated wastewater efficient reuse for irrigation in selected hydrological basins in Egypt, Morocco and Tunisia.

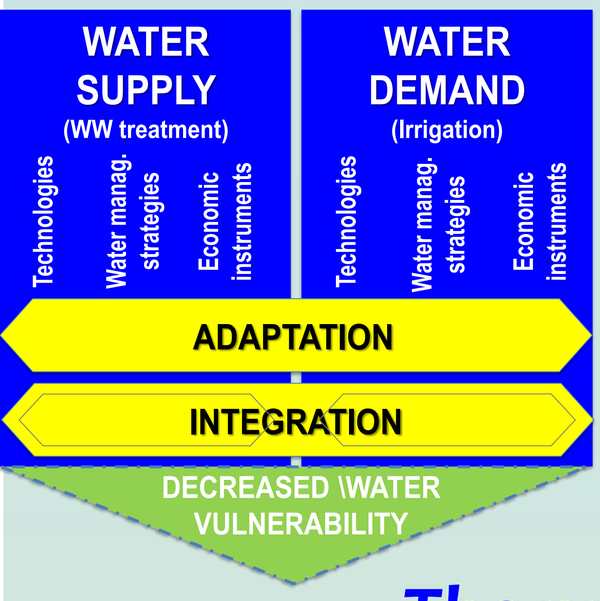
Aims of MADFORWATER

General goal

to develop integrated technological and management solutions to boost wastewater treatment, treated wastewater efficient reuse for irrigation in selected hydrological basins in Egypt, Morocco and Tunisia

Specific goals

- **improved analysis of water vulnerabilities in Egypt, Morocco and Tunisia**
- **development of technologies for wastewater treatment and agricultural reuse**
- **development of integrated water & land management strategies**
- **increased capacity building in relation to water management**
- **promotion of business opportunities for water & irrigation enterprises**



The MADFORWATER concept

- Madforwater is based on 2 pillars: **water supply (wastewater treatment) and water demand (irrigation)**
- Transversal key concepts:
  - ✓**adaptation** to the local conditions of Egypt, Morocco and Tunisia
  - ✓**integration** (i) *within each pillar*, between technologies, water management strategies and economic instruments; (ii) *transversally*, between wastewater treatment and wastewater reuse for irrigation

The project's technologies

Wastewater treatment technologies		Irrigation technologies
Canalized lagoon with nitrification/denitrification capacity	Phenolic compounds adsorption + anaerobic digestion	Micro-sprinkler and calibrated nozzle adapted to treated WW
Nitrifying trickling filters	Aerobic sequenced batch reactor	Re-engineered surface irrigation systems
Constructed wetlands with plant growth promoting bacteria	Granulated sludge bioreactor	Large spectrum soil moisture sensor calibrated for saline water
Enzymatic degradation of emerging pollutants, dyes and fungicides	Flotation + Moving Bed Biological Reactor (integrated)	Supply of plant growth promoting bacteria to increase crop resistance to water scarcity
Catalytic disinfection beds activated by solar UV light	Dyes adsorption with innovative resins	Open source software tool to determine the optimal irrigation amount and schedule

The project's strategy

- **Analytical phase** → evaluation of the water vulnerabilities in the 3 target countries
- **Technological phase** → lab-scale development and adaptation of technologies; **implementation of the best technologies in 4 demonstrator plants of wastewater treatment and agricultural reuse**
- **Implementation phase** → decision support tools, basin-scale water management strategies, policy recommendations, capacity building, industrial exploitation

The MADFORWATER pilot plants

- The most promising technologies are being scaled-up and validated by means of 4 pilot plants. Each pilot integrates wastewater treatment and treated wastewater reuse for irrigation. The wastewater flow-rate varies between 10 and 250 m^3/d.

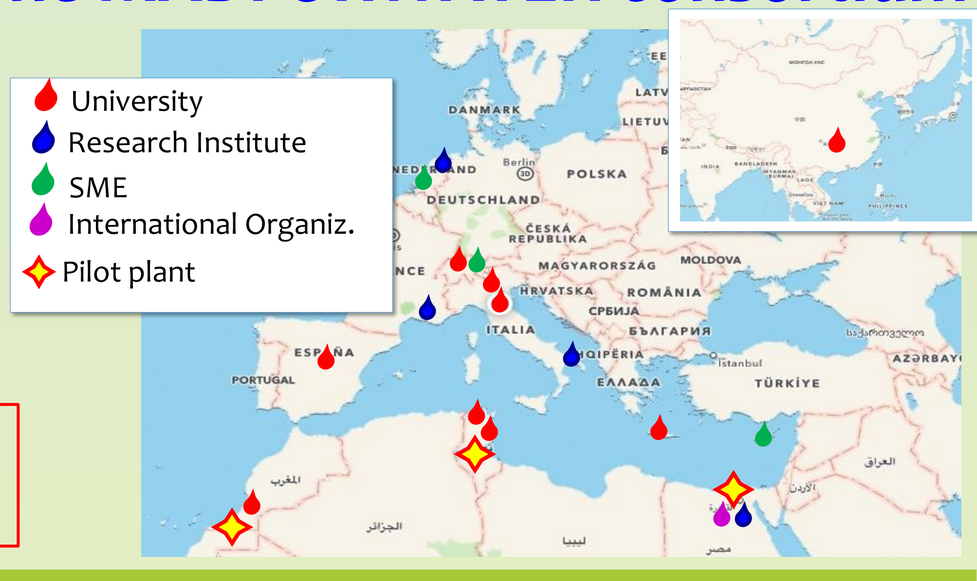
Pilot n. 1, Tunis, Tunisia. Municipal wastewater treatment by means of **innovative trickling filters and constructed wetlands**. Irrigation of wheat and corn by means **of calibrated nozzles, micro-sprinklers and plant growth promoting bacteria**.

Pilot n. 2, Nabeul, Tunisia. Textile wastewater treatment by means of **moving bed bioreactor and adsorption on innovative resins**. Irrigation of sorghum and triticale by means of **calibrated nozzles and micro-sprinklers**.

Pilot n. 3, Agadir, Morocco. Municipal wastewater treatment by means of **anaerobic lagoons and sand filtration**. Irrigation of olive trees by means of **calibrated nozzles**.

Pilot n. 4, Lake Manzala, Egypt. Drainage canal water treatment by means of **lagoons and constructed wetlands**. Irrigation of cotton and sugar beet by means of **gated pipes**.

The MADFORWATER consortium



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