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Novel Methodology for the Promotion of Treated Wastewater Reuse for Mediterranean Crops Improvement

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Water JPI
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CONSORTIUM DESCRIPTION

ACRONYM	TOPIC	Coordination	Partners
MEPROWARE	**2**		
Novel Methodology for the Promotion of Treated Wastewater Reuse for Mediterranean Crops Improvement		**water resources management; stakeholders involvement; modeling; treated wastewater reuse; irrigation; mediterranean crops**	

PRINCIPAL INVESTIGATOR	INSTITUTION	COUNTRY
Alfieri Pollice	**IRSA CNR, Water Research Institute of the National Research Council of Italy**	**Italy**
Jorge De las Heras	UCLM, University of Castilla – La Mancha	Spain
Gonçalo Rodrigues	ISA LEAF, Instituto Superior de Agronomia Universidade de Lisboa	Portugal
Nicola Lamaddalena	CIHEAM IAMB	Italy

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Partnership

IRSA CNR
Istituto di Ricerca Sulle Acque
Consiglio Nazionale delle Ricerche

UNIVERSIDAD DE CASTILLA-LA MANCHA

CREA
Centro Regional de Estudios del Agua

INSTITUTO SUPERIOR DE AGRONOMIA
Universidade de Lisboa

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LEAF

CIHEAM
IAM BARI

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Reference National research institution for freshwater monitoring, wastewater treatment, and water resources management.

Covers various aspects of water management, surface and groundwater ecosystems, treated wastewater reuse on crops.

Wide experience in wastewater treatment, waste recovery and bioenergy, irrigation scheduling and modelling of woody crops.

Expertise in stakeholders involvement, hydro-economic modelling, irrigation design and management, agronomic practices.

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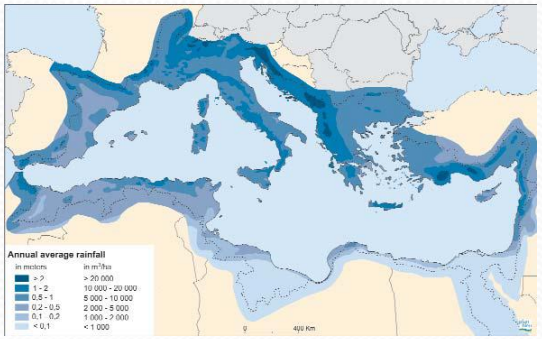
Background

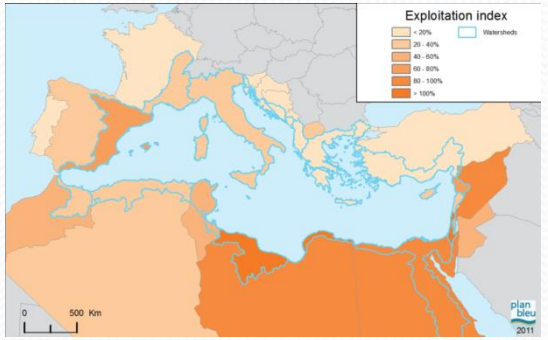
Factors affecting water stress in Med countries:

1. Increasing coastal urbanization.
2. Seasonal water stress (warmer season) due to simultaneous increase of:
   - Tourism fluxes,
   - Agricultural requirements,
   - Uneven precipitations and higher temperatures (climate change),
   - Over-exploitation of natural resources.

Possible tools to tackle water stress include:
- Water demand management
  (water loss contrast, irrigation techniques, economic measures, training, etc.)
- Water supply increase
  (seawater desalination, wastewater reuse, rainwater harvesting etc.)



Yearly rainfall in the Med Basin



% of available water yearly abstracted

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Background

Reuse of treated wastewater in agriculture

Opportunities

- Continuous water supply;
- Safeguard of primary sources;
- Nutrients supply.

Risks

- Microbiological safety;
- Chronic effects on soils;
- Eutrophication of storage basins.

Questions

- Are costs sustainable ?
- Are technologies adequate ?
- Are limits and regulations representative of local situations ?
- How stakeholders and final users can be involved ?

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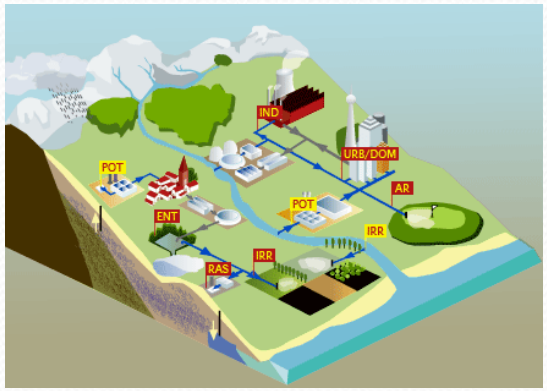
Background

Obstacles to TWWR in Med countries

Perceived complexity of TWWR (cross-sector issues concerning water, food, health and the environment) and need for some technical knowledge

Regulations not always suited to local contexts

Competition for conventional water resources and need to define priorities (need for planning supply and demand)



Inadequate tariff policy (heavily subsidized conventional water resources) and limited financial capacity

Risks of soil salinization, crops contamination, and pollution of water resources (need of monitoring procedures and some analytical skills)

Public perception could be highly negative, causing rejection of projects

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Objectives of MeProWaRe

General objectives

- Develop a new methodology for favouring the implementation of treated wastewater reuse (TWWR) practices in Mediterranean countries;
- Demonstrate effectiveness, suitability, and economic profitability of reuse for the irrigation of olive trees and vines;
- Enhance the involvement of stakeholders through direct participation to the activities.

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Proposed innovation

1. Technical innovation

Develop a methodology for TWWR also by blending with conventional water sources (to match irrigation needs, savings of natural resources and nutrient recovery).

Compare treated wastewater quality and stability at the three test sites and assess the effects of irrigation of olive trees and vines in terms of product quality, yield, and plant physiology.

Define adaptive fertilization programs that consider the nutrient contribution of treated wastewater at the different phenological stages of the crops.

Model and simulate evapotranspiration (dual Kc approach), nutrient balance (RZWQM) and migration of pollutants (Hydrus), to optimize water and nutrient needs.

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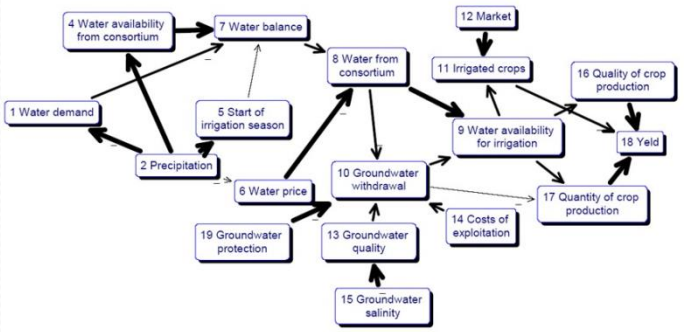
Proposed innovation

2. Non-technical innovation

Develop information sharing strategies through water users' behavioural models (Cognitive mapping).

Promote stakeholders' involvement through direct participation and training activities aimed at building public acceptance.



Raise public awareness on the positive environmental impacts through the Water Footprint Sustainability assessment in the case studies.

Demonstrate the cost effectiveness of treated wastewater reuse for irrigation and contribute to reformulation of water pricing policies (Cost/benefit analysis).

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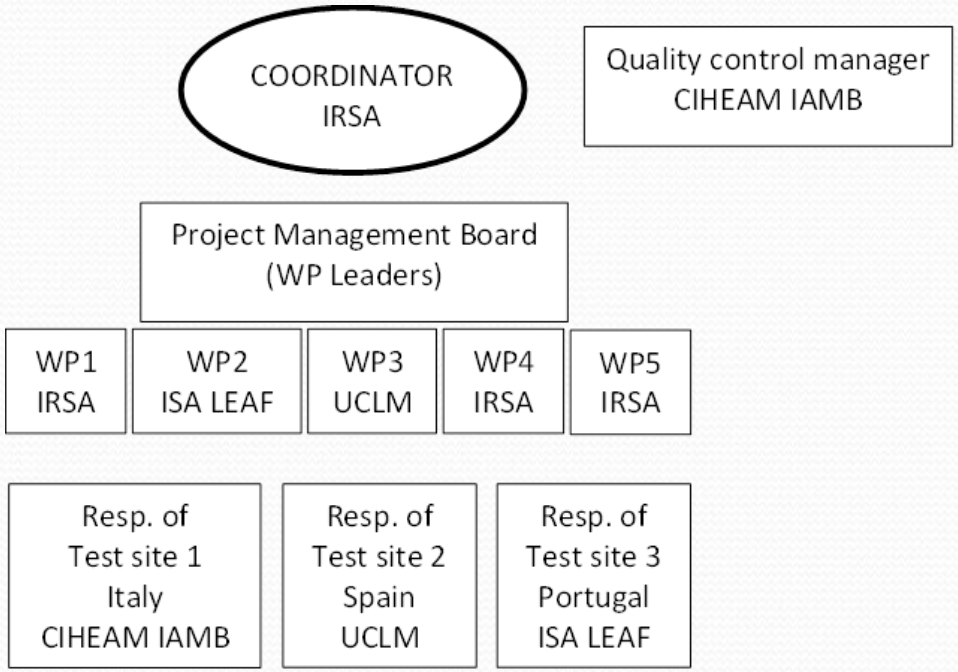
Structure and Workpackages



WP1: Water quality monitoring – leader IRSA;
WP2: Modeling tools – leader ISA LEAF;
WP3: Irrigation and agronomic practices – leader UCLM;
WP4: Stakeholders' participation and socio-economic evaluations (including cost/benefit, communication and dissemination) – leader IRSA;
WP5: Project management – leader IRSA.

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Production of experimental data

WP1: Water quality monitoring (IRSA)

T1.1 Define common monitoring protocol
T1.2 Water quality monitoring

WP3: Irrigation and agronomic practices (UCLM)

T3.1 Design of experiment and location
T3.2 Irrigation tests
T3.3 Sampling and analyses

Test site 1 Italy (CIHEAM IAMB)	**Test site 2** Spain (UCLM)	**Test site 3** Portugal (ISA LEAF)

WP2: Modelling tools (ISA LEAF)

T2.1 Calibration of SIMDualKc model
T2.2 Calibration of RZWQM (Root Zone Water Quality Model) and Hydrus model
T2.3 Model application with data from the 3 sites

WP4: S/h' participation and socio-economic evaluations (IRSA)

T4.1 S/h' understanding of the problem (cognitive mapping)
T4.2 Econ./environmental impacts of water reuse (cost/benefit, WFS)
T4.3 Communication/disseminantion strategy

Data management

Test site 1 - Italy (CIHEAM IAMB)

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Stakeholders: Farmers association, water utility, municipality.

800 m³

150-200 m³/h

well

900 m³

Water types:
- Well water;
- Treated wastewater;
- Blend of the two.

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Test site 2 - Spain (UCLM)

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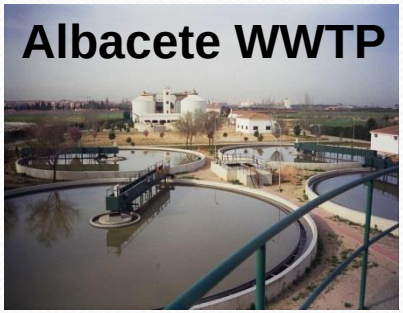
- Crop selection (varieties, soils, plants age).
- Each plot will be divided into 3 replicates; 2 water treatments will be considered:
  - Conventional water source (control).
  - Treated wastewater.



- Plots irrigation through flood, sprinkler, drip.
- Rainfall, average temperature and sunlight will be recorded during the experimental period.
- Water, soil and plant will be sampled to study their evolution.

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Test site 3 - Portugal (ISA LEAF)

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ISA premises and test fields

- Assess water use and evapotranspiration partition through the SIMDualKc model.
- Simulate nitrogen and fertilizers balance in the Soil-Plant-Atmosphere-Continuum (SPAC) using RZWQM model.
- Estimate the fluxes of potential pollutants to groundwater using HYDRUS and RZWQM models.

Both the olive grove and the vineyard will be irrigated with three different treated wastewater and conventional water in a control row (quality and yield assessment).

ISA LEAF team will provide data obtained during the development of previous research projects and consultancy for agro-industries.

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Expected results

- Validation of a methodology for treated wastewater reuse, also involving blending with conventional water resources according to the nutrient requirements of the different phenological phases of olive trees and vines.
- Assessment of cost-effectiveness, pricing criteria, and long term sustainability of TWWR.
- Identification of key actions to increase stakeholders' acceptance and awareness towards the opportunities of TWWR.
- Contribution to the improvement of national and regional regulations.

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THANKS FOR YOUR ATTENTION

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Objectives of MeProWaRe

Specific objectives

- Show the positive effects of reuse for irrigation, also combined with other sources, in terms of quality and yield of the selected crops;
- Apply specific modelling tools to water and nutrient optimization in agricultural practices, along with the assessment of pollutants' transfer through irrigation;
- Relate the different phenological stages of the tested crops to their needs in terms of water and nutrients;
- Assess the barriers to effective communication between scientific communities and stakeholders, and increase stakeholders' acceptance;
- Contribute to treated wastewater pricing and cost allocation by integrating cost/benefit evaluation methods with non-conventional approaches;
- Evaluate the appropriateness of national regulations also in relation to the European legislation on the management of natural resources.

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